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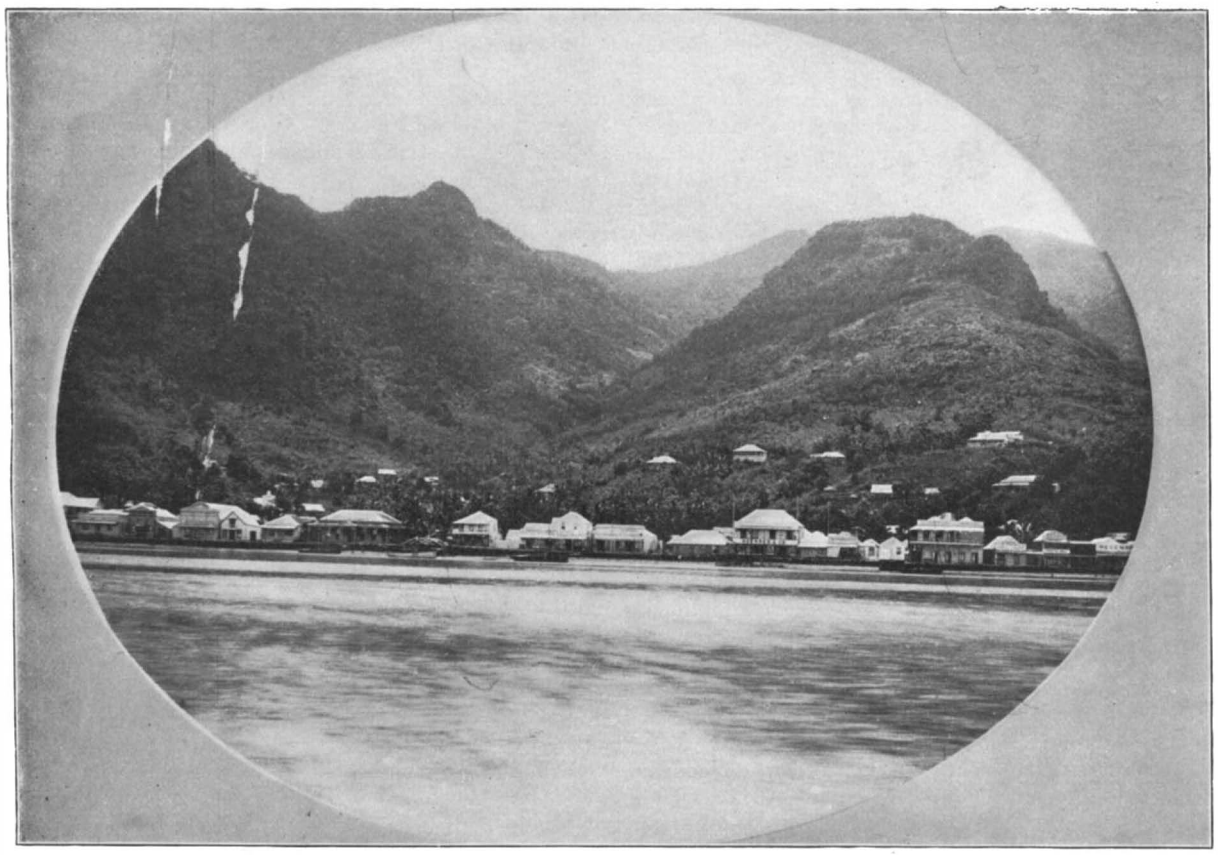
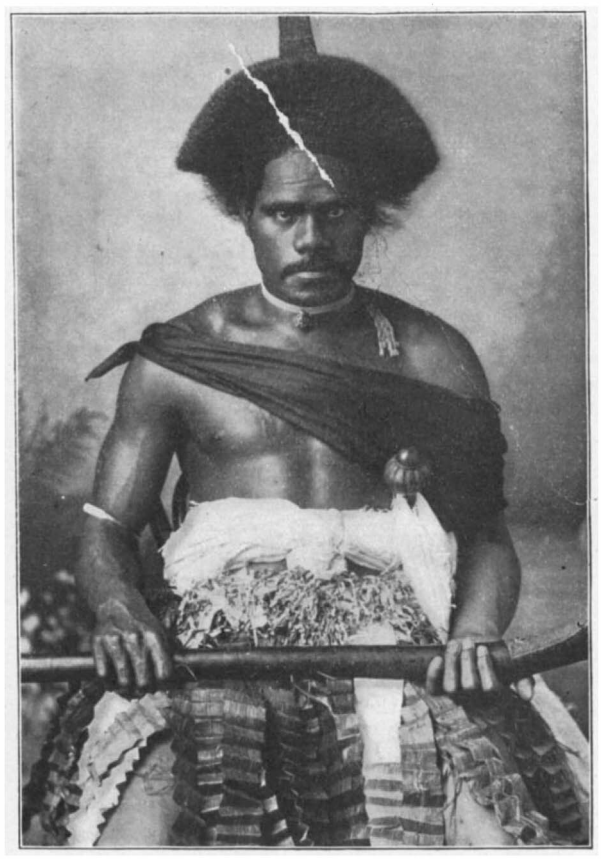
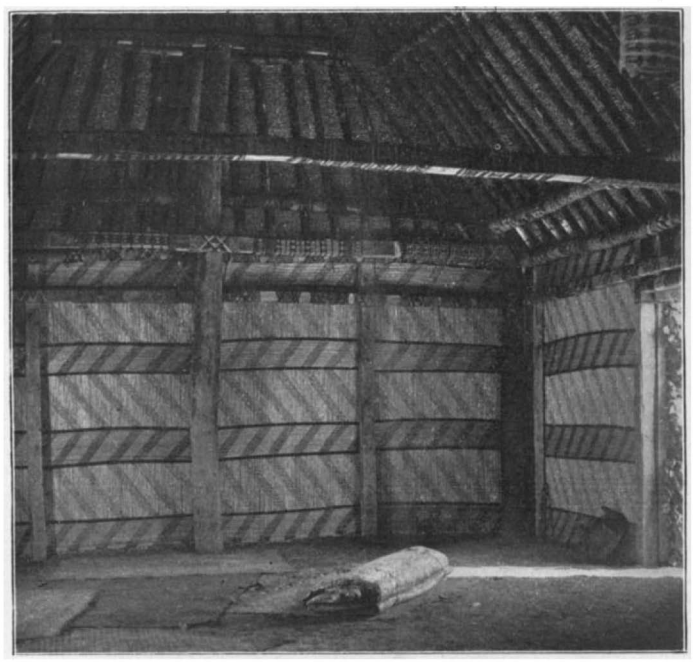


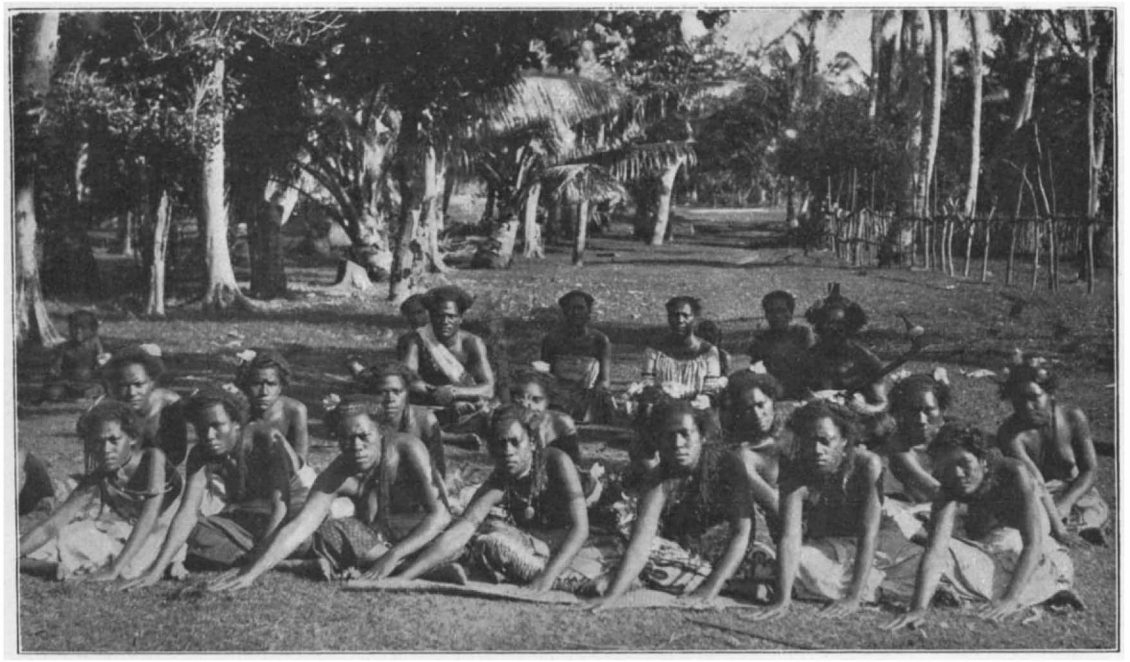
Levuka—Former Capital of the Fiji Islands.



Native Warrior.



Interior of Hut.



The "Wave" Meke-Meke.

A Native Catamaran, Fiji Islands.

The Coral Strand.

THE FIJI ISLANDS AND THE FIJIANS.—[See page 448.]

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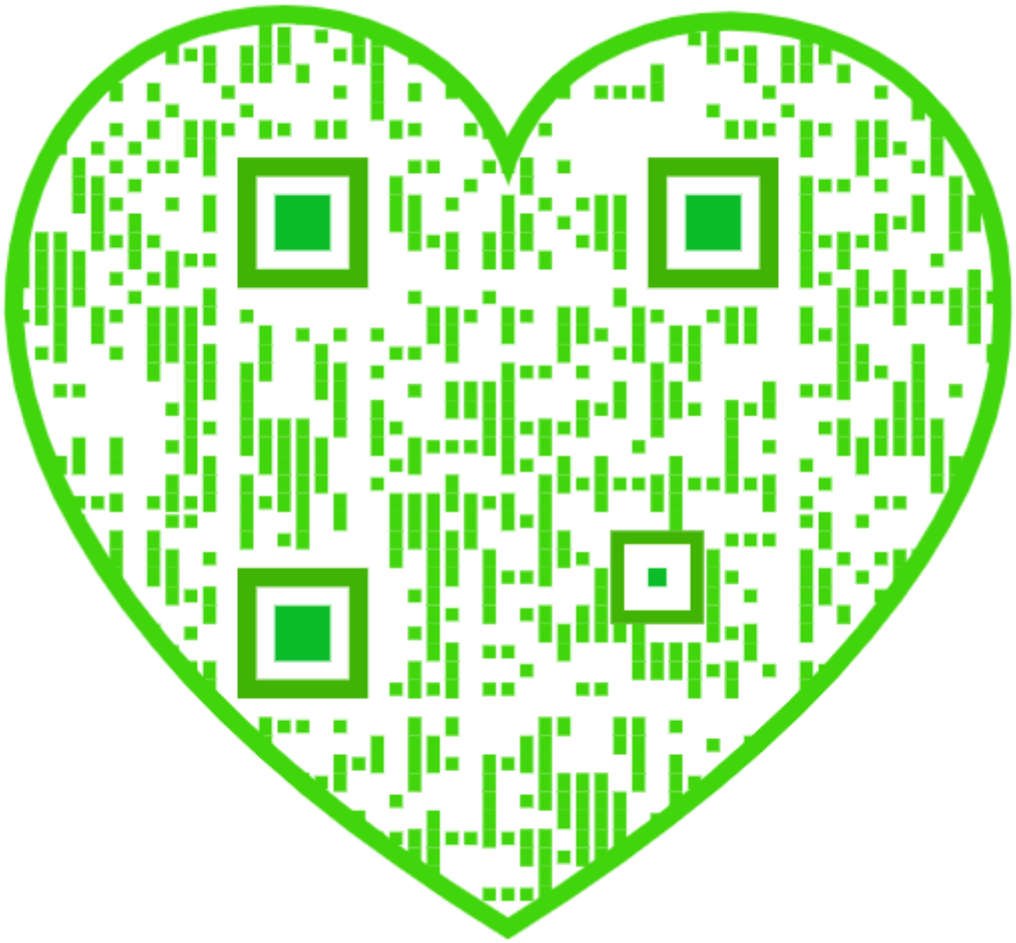

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NEW YORK, SATURDAY, JUNE 28, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

THE SENATE PANAMA CANAL BILL.

It is gratifying to note that the international canal question is finally to be settled in a way that we have contended was the only practical one, that is in favor of the short Panama route—a route also favored by the Isthmian Canal Commission. The Senate on the 19th instant passed the Panama Canal bill by a vote of 67 in favor to 6 against.

The radical change in sentiment as here illustrated, in comparison with the Hepburn Nicaragua House bill, may be largely accounted for by the masterly way in which the Canal Commission placed the result of its investigations before Congress, sufficient to convince many men of a practical turn of mind of the several advantages of the Panama route. In addition to this the recent terrible disaster at St. Pierre, Martinique, caused by the tremendous volcanic eruption of Mont Pelée, fixed in the minds of many the futility of constructing a canal in a region having a record for volcanic disturbances and earthquakes.

Thus when the merits of the Panama Canal became fully known and the possibility of its acquirement for a reasonable sum and the probability of securing the desired right of way on equitable terms, there was an irresistible sentiment created in its favor which is reflected in the nearly unanimous vote of the Senate. In the debate preceding the vote the shortness of the Panama Canal as compared with the Nicaragua was emphasized as one of the important points of its advantage—49 miles, as against 183. The depth is to be 35 feet. The principal provisions of the Senate bill are:

1. That the President is to acquire for the United States, at a cost not exceeding $40,000,000, all of the rights, privileges, franchises, concessions, grants of land, rights of way, unfinished work, plants, and other property owned by the New Panama Canal Company of France on the Isthmus of Panama and all its maps, plans, drawings, records on the Isthmus of Panama and in Paris, including all the capital stock, not less, however, than 68,862 shares of the Panama Railroad Company, owned by or held for the use of said canal company, provided a satisfactory title to all of said property can be obtained.

2. That the President is to acquire from the Republic of Colombia exclusive and perpetual control of a strip of land not less than six miles wide from the Caribbean Sea to the Pacific Ocean, and the right to use and dispose of the waters thereon, and to excavate, construct, and perpetually to maintain, operate, and protect thereon a canal of such depth and capacity as will afford convenient passage of ships of the greatest tonnage and draught now in use, from the sea to the ocean; this control to include the right perpetually to maintain and operate the Panama Railroad, if the ownership thereof, or a controlling interest therein, shall have been acquired by the United States; also jurisdiction over the strip and the ports at the ends thereof, to make the necessary police and sanitary rules and regulations, and to establish judicial tribunals to enforce the same. The President also may acquire such additional territory and rights from Colombia if deemed necessary.

3. $40,000,000 is appropriated to pay for the property of the New Panama Canal Company and a sufficient amount to pay Colombia for the territory acquired from that country for building the canal. The President is then, through the Isthmian Canal Commission, authorized by the act to proceed with the construction of the canal, utilizing as far as practicable the work already done. The canal is to be supplied with all necessary locks and other appliances. Provision is made for the construction of safe and commodious harbors at the termini of the canal, and for such works of defense as may be necessary for the safety and protection of the canal and harbors.

4. In the event that the President is unable to secure a satisfactory title to the property of the New Panama Canal Company and the control of the necessary territory from Colombia, and after first having obtained for the United States exclusive and perpetual control by treaty of the necessary territory from Costa Rica and Nicaragua, he is then to have authority to begin the construction of the canal over the Nicaragua route on the same general conditions as apply to the Panama Canal. An appropriation is provided for compensation, through a treaty, to Costa Rica and Nicaragua for rights and concessions they are to grant.

5. An appropriation of $10,000,000 is made to begin the project, and by a further provision all appropriations are not to exceed in the aggregate the additional sum of $135,000,000 if the Panama route be adopted, or $180,000,000 should the Nicaragua route be selected.

6. In any agreement made with Colombia, Nicaragua or Costa Rica the President is authorized to guarantee them the use of the canal and harbors, upon such terms as may be arranged, for all vessels owned by those countries or by their citizens.

7. An Isthmian Canal Commission of seven members is created, to be nominated by the President and confirmed by the Senate. They are to have charge of construction of the canal and are to be subject to the direction and control of the Executive. Four of the seven are to be skilled in the science of engineering, one is to be an officer of the army, and one other an officer of the navy. Authority is given for the employment of engineers from the army and civil life and other necessary persons. The commission is to make reports to the President and to give Congress such information as may be required.

8. Outside of the $10,000,000 appropriated authority is given for the issue of $130,000,000 2 per cent 20-year gold bonds exempt from taxation in denominations of $20, or a multiple of that sum, to be sold at par and open to popular subscription, the proceeds to be used on the construction work as required.

The provisions above stated appear to give the President ample authority to proceed with this great work in a common-sense, business-like way, while much will depend upon the character of the Commission whom he appoints as to whether the vast expenditures necessary for construction will be reasonable and economical or extravagant. As the personnel of the Commission must be confirmed by the Senate, it is to be presumed only the best men will be selected.

The assurance that a canal is positively to be constructed on a practical and economical basis with funds provided in part by popular subscription will create a national enthusiastic interest in it and insure its success. Its commercial advantages to this and foreign countries cannot be over-estimated. We trust that the differences between the House of Representatives and the Senate may be satisfactorily adjusted by the usual conference committee in the hope that by the next celebration of Independence Day the wishes of the country in respect to this great undertaking may be carried out.

THREE PHASE TRACTION IN AMERICA.

The announcement that the Whitney syndicate has joined hands with Ganz & Co., of Buda-Pesth, is fraught with more promise for the future of electric traction in the United States than many of us may be willing to admit. For years the Buda-Pesth firm has been identified with the growth of electrical traction in Europe. Not only did it install the first underground trolley, but it developed the three-phase system for roads of standard gage.

The number of electrical roads in this country of standard dimensions can be counted on the fingers of one hand. Probably, without exception, all of them use the direct current. In Europe, on the other hand, the foremost electrical engineers have adopted the alternating current, with results that have been most gratifying from the standpoint of economy and efficiency.

Readers of the SCIENTIFIC AMERICAN will recall the article we published some time ago on the Valtellina road, in Italy. That road was converted from steam to electrical traction by the Buda-Pesth firm. After having been in continuous operation for over one year and a half, the company was able to announce that the three-phase electrical equipment had cut down the operating expenses fifteen per cent. Unfortunately, the Valtellina line had hardly been opened, when the London underground contracts were let. In the bitter fight in which Mr. Yerkes and the American advocates of the direct current finally triumphed, the merits of the three-phase system were ably and strongly put forth by its adherents. The Board of Directors of the London Underground, after a careful investigation, decided in favor of the three-phase system. But the strenuous protests of the Americans resulted in the submission of the controversy to a board of arbitrators, who rather weakly decided that the Buda-Pesth plan was too new.

It may be that the London controversy, however, brought home to the Whitney syndicate the merits of three-phase traction. At all events, it is encouraging to find that American engineers are willing to try a system of which as yet they know next to nothing, and which has been offered to them as a vast improvement on their own; and it speaks well for the Buda-Pesth firm if sagacious American men of wealth are willing to invest millions in a plan which originated in Europe and developed there to its present importance.

TWO REMARKABLE RAILWAY RUNS FROM NEW YORK TO CHICAGO.

Probably no more praiseworthy feat is recorded in the annals of American railroading than the performance of the trains sent by the New York Central and Pennsylvania Railroads over the roads between New York and Chicago. At a speed which sometimes exceeded 80 miles an hour, and which averaged some 50 miles an hour including all stops, these trains, traveling east and west, covered the respective distances of 980 and 912 miles three minutes ahead of the schedule time of 20 hours.

With these two remarkable records, American railroads hold the record for fast, long runs. On the Orleans & Midi Railroad, the Sud express travels 486 miles from Paris to Bayonne in 8 hours 59 minutes, averaging 54.13 miles an hour. That is probably the fastest train in the world for the distance. But the length of track is little more than half that traversed on the shortest route between New York and Chicago. Other famous European runs that deserve mention are those made in England by the East Coast express and the West Coast express. The former runs to Edinburgh, and the latter to Glasgow from London. Both travel at an average speed of 50 miles an hour; but the distance covered is only about 400 miles.

It is difficult to award the palm to either of these new American trains. The New York Central's express covered a longer distance at a higher average speed than the Pennsylvania train. On the other hand, the Pennsylvania train, although its route was shorter and its average speed not more than 45½ miles an hour, encountered heavy grades in crossing the Alleghany Mountains. The officials of both roads claim that the journey from New York to Chicago could easily be covered in 18 hours.

GOVERNMENT IRRIGATION.

One of the best measures that has become a law in the beginning of this twentieth century is the scheme providing for the irrigation of the thousands of square miles of arid lands located in our Western States and Territories under government supervision, embodied in the bill recently passed and signed by the President and known as the Irrigation Bill.

The bill is based on the idea that the proceeds of sales of public lands shall be assigned from year to year to the building of irrigation works under contracts approved by the Secretary of the Interior, but only when there is sufficient money on hand to insure the completion of the work.

According to Mr. Newlands, the Representative from Nevada who has promoted the legislation on this subject, this bill is very complete and comprehensive in its scope and automatic (so to speak) in its plan of action.

It is estimated that during the next thirty years at least $150,000,000 from the proceeds of the sale of lands will be available without further appropriations for public irrigation works.

The bill makes the present receipts from public lands, including those of the last fiscal year, stated to amount now to some $6,000,000, immediately available and the average annual sum of $3,000,000 (likely to be constantly increased) can be used each year for a steady continuation and enlargement of any work for which contracts are made.

The plan further provides against the acquirement of large tracts of land by individuals or companies by limiting the area to be owned by one person to 160 acres, subject to the provisions of the national homestead law, including its limitations, charges and conditions.

At least half of the arid land so acquired must be improved by irrigation and the owner must reside on or near the land.

After a plan of irrigation of a tract of land owned by several parties has been completed at government expense and the works are in order, the owners will be required to pay back to the government in not less than ten annual installments the estimated cost of the construction of the works, the money so paid to be returned to the general reclamation fund. Eight hours is fixed as a day's work, and Chinese labor is forbidden.

The public arid and semiarid lands mentioned are in the Territories and States of Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington and Wyoming.

The effect of the bill should be to encourage the settlement of the great wastes in a few of the States and greatly to increase their agricultural products. The

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Department of the Interior is not limited to any particular plan of securing the requisite supply of water for irrigation purposes, but must conform to the State laws bearing on this subject in providing for any given plan. The law is certain to make valuable land now considered valueless, and promote Western agriculture in a way to insure lasting benefit to the country.

THE HEAVENS IN JULY.

BY HENRY NORRIS RUSSELL, PH.D.

The summer evening skies, though not perhaps equal to those of winter, present at this season a noble spectacle. To identify the principal constellations, we may begin with the two brightest stars in sight—Vega and Arcturus. The former of these is nearly overhead at 9 o'clock in the evening in the middle of July, while the latter is some distance to the westward. Starting from Arcturus toward Vega, we first reach the little circlet of stars which is known as the Northern Crown. Next comes a keystone-shaped figure which marks the constellation Hercules. Following the same line beyond Vega, we come to Cygnus—a fine cross of stars in the Milky Way. The bright stars rising in the east below this belong to Pegasus.

In the Milky Way, to the right of Cygnus, the bright Altair shows the position of the constellation of the Eagle. Below this is Sagittarius. Its most noteworthy feature is a little inverted "dipper," known as the Milk Dipper, because it lies in the Milky Way.

Scorpio, the finest of the zodiacal constellations, is due south. The brilliant red star Antares, at the creature's heart, and the long curving line of the tail, streaming down to the horizon and then bending upward again, make this one of the easiest star groups to recognize when once learned. Above it are the large but rather formless constellations of Ophiuchus and Serpens. The conspicuous isolated star in the southwest is Spica, the brightest one in Virgo. Leo is setting, a little north of west. Ursa Major is well up on the left of the pole, the Great Dipper being the highest part of the constellation. The Little Dipper is right above the pole-star. Half-way between its bowl and Vega is the head of Draco, whose long coils may easily be traced through the space between the Great and Little Bears. In the Milky Way, low down on the right of the pole, is Cassiopeia.

THE PLANETS.

Mercury is morning star throughout July. On the 15th he is farthest west of the sun, and about this time he can be seen a little north of east, about an hour before sunrise. By the end of the month he disappears again in the sun's rays.

Venus is morning star in Taurus and Gemini, rising about two hours earlier than the sun.

Mars is also morning star, though far away and faint. On August 1st he is in conjunction with Venus, being about 1¼ deg. north of her—not quite so close as he was last fall. As the moon is close by at the time, there will be something worth looking at in the eastern sky that morning.

Jupiter is approaching opposition, and is conspicuous in the southeast in the latter part of the evening. On the 15th he rises at about 9 o'clock, and is due south at half-past 1.

Saturn is in Sagittarius, and is in opposition on the 17th. It is interesting to note that at this time the earth passes directly between Saturn and the sun, so that as seen from the planet it would appear to transit across his disk. It may help us to realize how small a body the earth is, in comparison with even the solar system, when we find that it would appear to an observer on Saturn as a black dot barely two seconds of arc in diameter—too small to be seen at all without a good-sized telescope.

Uranus is in Ophiuchus, well placed for evening observation. Neptune is morning star, too near the sun to be well seen.

The asteroid Vesta, as we mentioned last month, comes to opposition on the 14th. It is in Sagittarius, and is moving parallel to a line drawn from Saturn to the middle of the bowl of the Milk Dipper, but about a degree below this line. On July 1st it is about 1 deg. southwest of Saturn, and on the 31st it is 3-5ths of the way toward the Milk Dipper. It is of the 6th magnitude, and is consequently just visible to the naked eye under favorable conditions. Without a very good star-map it will be necessary to sketch the stars visible in this region with a field-glass and pick out the asteroid by its motion.

Vesta is the brightest—though the third in order of discovery—of the hundreds of small planets between Mars and Jupiter. It revolves about the sun at an average distance of 220,000,000 miles, and takes about three years and eight months to complete its journey. At the present opposition it is nearer than usual, being 203,000,000 miles from the sun, and 109,000,000 miles from us. While it is ordinarily just too faint to be seen by the naked eye, this unusual nearness carries it just within the limit.

In the most powerful telescope Vesta, like a few others of the brighter asteroids, shows a perceptible disk. According to Prof. Barnard's measures, it is about 200 miles in diameter, so that it is decidedly a world in miniature.

On so small a body the force of gravity is much less than on the earth. A man, if he could exist on the surface of Vesta, would weigh about 1-50th of what he does here, and his capabilities would be correspondingly increased. This would have some interesting consequences. An athlete, for example, could easily jump to a height of 300 feet or so, coming down with no more jar than after a six-foot leap on earth. A batted ball, which here rises to a height of a hundred feet, and drops into the fielder's hands after a flight of five seconds or so, would on Vesta, if struck as hard a blow, rise a mile high, stay in the air more than four minutes, and drop nearly four miles away. A cannon-ball, fired at the usual speed, would fly clean off into space, and never come back at all.

Clearly life on such a planet would be rather remarkable. However, as it is almost certain that the asteroids have no atmosphere, such calculations as we have just been making really belong to the realm of idle speculation.

THE MOON.

New moon occurs on the morning of the 5th, first quarter on that of the 12th, full moon near noon on the 20th, and last quarter on the night of the 27th. The moon is nearest us on the 4th, and farthest off on the 16th. She is in conjunction with Venus on the 2d, Mars on the 3d, Mercury and Neptune on the 4th, Uranus on the 17th, Saturn on the 20th, Jupiter on the 21st, and Mars and Venus once more on the morning of August 1st.

FORCED AND SHRINK FITS.

BY C. D. KING.

Forced and shrink fits have long been used by engine, ordnance and machinery builders, the forced fits being obtained by driving with a heavy weight or by hydraulic and screw presses. While it was once the custom to taper the holes and shafts in forced fits, it is now conceded to be much better to have them perfectly cylindrical throughout.

If we wish to shrink a sleeve or ring of metal onto a shaft or tube, we bore the hole a trifle smaller than the diameter of the shaft to go in it—1-80 inch per foot of diameter of shaft is a common practice, then by heating the sleeve, we expand it, hole and all being increased in diameter until it will slip onto the shaft. When it cools it is in a state of tension, and the shaft inside of it is compressed, the amount of tension or compression depending upon the difference in the diameters of the two pieces. If we attempt to pull the sleeve off the shaft, it is found that we require a large amount of force to do it. Both sleeve and shaft were brought to a smooth finish apparently, where they were to fit together, but upon careful examination with a miscroscope, we find numerous irregularities on those surfaces that are to come together. The irregularities are mostly annular groovings formed by the lathe tools and files. Now when we shrink the sleeve on, in cooling, the little projections on one piece will sink into the depressions in the other and *vice versa*. Thus the sleeve is firmly locked upon the shaft. Reasoning from the above analysis we conclude that the surfaces in contact should be finished rather roughly to the touch, so that the irregularities and minute groovings of one piece may hold more firmly on those of the other.

It has been found in the crank-pin fits for locomotives, that if the pin and hole are finished to very smooth and true surfaces, the pin will be pressed in by a force of six tons per inch of diameter, but when they are rougher the force may have to be increased to as much as nine tons for each inch of diameter. This leads us to conclude, that it will be more difficult to withdraw a rough piece than a smooth one, and consequently more difficult for it to work loose, although the tension in the crank and the pressure on the pin may be nearly the same as when the pin was smooth, which is a most desirable feature. Inasmuch as heating and cooling tend to change the form of pieces, and if they are of cast iron, is apt to crack them, we prefer the forced fit where practicable, but the turning of the fits must be done accurately, and they must be truly round. They must also be of uniform diameter throughout, and not tapered in the least. Both the commencement of the hole, and the end of the piece to go in it, should be slightly rounded so as to start in readily. When one piece is forced into another as described above, the little projections have a tendency to be rubbed backward on one piece, and in a forward direction on the other, forming, we could say, little ratchet teeth. If we provide a shoulder or collar on one of the pieces for the other to stop against, we have the pieces pretty effectively locked against working loose.

A point in the manufacture of chainless bicycles, came recently to the attention of the writer, regarding the fastening of the gears to the crank shafts and rear hubs. The shafts and rear wheel hubs are threaded externally with right hand threads. The gears are threaded internally with threads which fit so tightly that considerable force is required to turn them onto the shafts and hubs. A fixture is made purposely for this work with a chuck to hold the hub or shaft and a "crab" to hold the gear. A very long crank is used to get sufficient power to turn the gears into position. The force in back pedaling, it is found can never be sufficient to turn them off even to the slightest amount.

The minute irregularities of the external threads on the hub coming in contact with other irregularities in the internal threads of the gear, form, as it were, a ratchet with innumerable pawls preventing it from turning backward.

ENGINEERING NOTES.

Texas oil is to be used by the great Minneapolis flour mills instead of coal. From the experiments made it would seem that the use of oil is entirely practicable. A street railway company of Minneapolis and St. Paul is also conducting tests with Beaumont oil.

A marine engineer of Rochester, England, has patented a new system for steering twin-screw steamships. His device consists of a special throttle valve attached to each set of engines, the valves being connected by means of bell cranks and linkwork to a tiller. When the tiller is resting centrally an equal supply of steam enters each engine, but directly the tiller is deviated from its central position in either direction, the throttle valve fitted to one set of engines reduces the supply of steam, so that the propeller actuated by that particular engine revolves more slowly, the rotatory motion of the screw diminishing according to the degree to which the tiller is moved over.

The great scheme of the late Mr. Cecil Rhodes, the Cape to Cairo railway, is being pushed forward with all possible celerity. The road has been surveyed as far as the Zambesi River, which is to be crossed by a great steel bridge, having one span of 500 feet, at the Victoria Falls. The whole section from Bulawayo to the Zambesi, 275 miles in length, is to be opened next year. Locomotives for contractors' purposes are now running on it for a short distance north of the present terminus, and a railway exploration party has been dispatched over the railway route beyond Victoria Falls as far as Lake Tanganyika. For forty miles north of Bulawayo the embankment of track is more or less complete, bridging work on the Victoria Falls section is in progress, and about five miles of the line are finished. The work of connecting the Bulawayo and Salisbury sections is also progressing rapidly, and rails are already laid from Salisbury to Sebakwe, a distance of sixty miles. From the Bulawayo end of this line the railroad has reached the Arguza River, so that when this gap is filled and the line completed, as it is hoped it will be by the end of the present year, trains will be able to run from Cape Town to Beira via Bulawayo, Salisbury and Umtali.

Salt mining constitutes one of the staple industries of the little European country, Roumania. There are four mines in all. The most peculiar feature in connection with this industry is that the mineral is mined in three of the principal mines by convicts condemned to life and lengthy sentences of penal servitude. The reason for this is that crime in Roumania is practically unknown, and there is no death penalty. Under these circumstances the compusory mining of the convicts is beneficial both to the government and the laborers. In the case of the mine in which convict labor is not employed, the quarrying is performed by peasants, the work being assisted as far as possible by the most up-to-date mechanical time and labor-saving appliances, for the employment of which skilled labor is essential. In all there are about one thousand convicts at work in the three mines. The laborers are not provided with any mechanical apparatus whatever, the whole of the work being performed by hand, each convict having to quarry a specific quantity of salt daily. The mines are controlled by a state official, whose position is similar to that of governor of a prison. The mines are thoroughly well ventilated, and illumined with electric light, so that the lot of the convicts is somewhat alleviated, though to those who are serving life sentences it represents a living grave. The mines are worked in galleries, and the pure white crystal presents a weird and peculiar aspect, especially in reflecting the fitful electric light. The main shaft terminates at the bottom in a huge apartment with a dome-shaped roof, and from which all the working galleries radiate. The mine contains a chapel and numerous other apartments, all cut out of the salt by the prisoners. The director keeps a record of the name of each convict who enters the mines, his conduct and the efficiency and quantity of his work. Periodically the King of Roumania visits the mines and examines the official record, and in those instances where the results warrant such action, he extends a free pardon to the prisoner, or at any rate reduces the length of his sentence, so that good conduct and efficient work is an incentive to a royal pardon.

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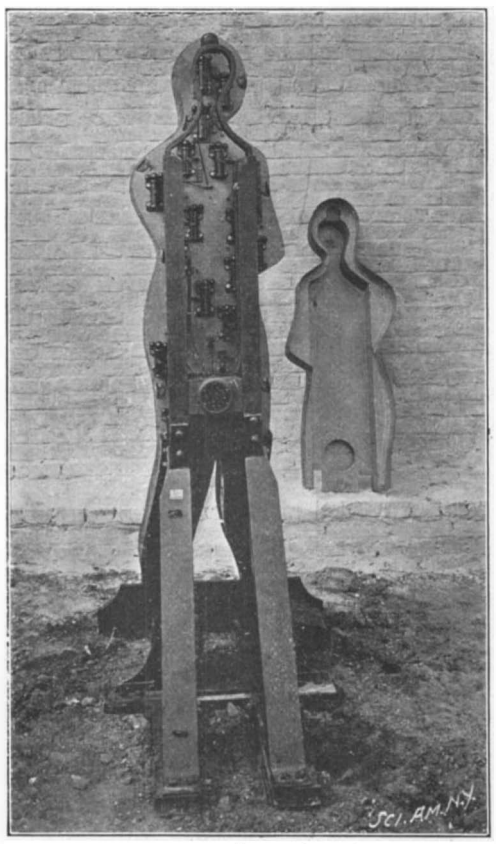
CHEVALLIER ELECTRIC TARGET.

Capt. Charles Chevallier, of the French army, collaborating with M. Eugène Cadet, has invented a most ingenious target which is so constructed that the hits are registered by an annunciator. By means of this device, the marksman simply by referring to the annunciator can ascertain at a glance what his success



BACK OF THE DUMMY TARGET WITH COVER REMOVED.

has been without walking several hundred yards to the target.

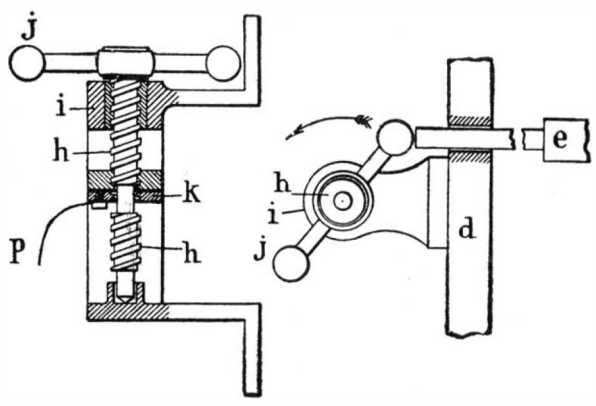
The target itself consists of two sets of metal panels of segmental form, arranged in different vertical planes. One series of segments overlaps to a certain extent the next series of segments, in order that an entirely full surface may be presented to the marksman. Behind each series of segments lies a fixed disk, serving as a guide and support for rods secured to the segments. Coiled springs are placed between the segments and the disk, in order to return the segments after they have been driven in by a projectile.

Opposite each rod, secured to the segments, an electric contact device is placed, which, as shown in our detailed views, consists of a screw, *h*, mutilated for about 7-16 of an inch. In its normal position, an insulated plate, *k*, having threads of a corresponding pitch to those of the screw, lies opposite the neck thus formed in the screw, and is therefore out of contact with the screw. The vertical screw, *h*, turns in a fixed nut or support, *i*. The upper part of the screw, *h*, is fitted with a crosspiece, *j*, provided with counterweights at its ends so as to form a balance member. The plate, *k*, constitutes one terminal of the circuit, the wires, *P*, being secured to the other terminal. The wires, *P*, are equal in number to the segments of the target and are assembled together in a cable leading to an annunciator of ordinary construction, placed near the marksman.

When a projectile strikes one of the segments, one or more of the springs, coiled about the rods, *e*, are compressed, and the corresponding rod or rods, *e*, are driven in through the perforations of the disk, *d*, and strike the counterweights of the balance member, *j*. The impulse thus given to the balance member, *j*, causes the screw, *h*, to turn and rise. The lower threaded part of the screw is then engaged in the screw threads of the plate, *k*, and the circuit is completed. When the circuit is completed the annunciator near the marksman indicates the exact spot of the target which has been struck.

Instead of disks, portions representing the human figure can be used.

This electric target has been successfully used in the armies of France, Spain, Roumania and Portugal.



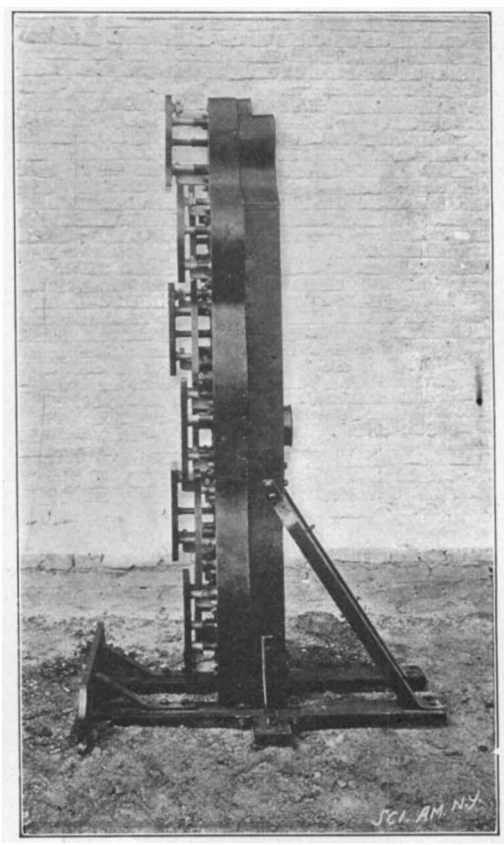
ELECTRIC CONTACT DEVICE OF THE TARGET.

Heavy Engines Money Savers.

All new orders from the big railway companies are for monster freight engines these days, and not a few are of the compound type.

The Union Pacific, Oregon Short Line, Rio Grande system, Burlington, Illinois Central, Northern Pacific, Pennsylvania, New York Central, Rock Island, Colorado Midland, Colorado & Southern, Missouri Pacific, the Erie road and others, have large orders in for locomotives and all of them include great freight-hauling machinery. For the past year or two a particular study has been made of the power problem, and while there is some difference of opinion among master mechanics and enginemen upon some points, yet there is unanimity with reference to some general facts, and among these latter is the preference for heavy engines as money savers. A. W. Sullivan, assistant second vice-president of the Illinois Central, has paid great attention to this phase of railway operation, and his conclusions are entitled to much weight. He refers to the difficulties in the system of double heading, which constitute offsets to the economy of the plan in other respects. Among these are delays on the road, the consequent overtime, the damage that is done to cars in "sawing" trains at meeting points where the siding is not long enough to clear the main line, the difficulties of handling the train over hilly portions of the road, and the uncertainty of trains' moving on orders to make meeting points on short time.

Precisely the same conditions apply to the movement of trains with very large engines, contends Mr. Sullivan, who claims that the Illinois Central at one time had the two largest locomotives in existence. They were simple engines, with cylinders 23 x 30; they carried 210 pounds of steam, had 82-inch boilers, long fire-boxes. One was a consolidation, the other a 12-wheeler. It was sought to find out what this size of engine could do in the way of ultimate pulling capacity, so the order was given to start with a train of 1,500 tons on a run out of Chicago of about fifty miles, in the middle of which was the ruling grade of that district, about 24 feet to the mile; and each day the engine made the trip, increasing the train load by 500 tons until the train got to 3,500 tons, or 82 loaded cars. The engine hauled the train easily; the trouble was to handle the engine. This was about two years ago. When the engine arrived at the station at the summit of the grade, it had to cross over to the other track to let an important passenger train pass it, necessitating a short back-up movement to enter the crossover track.

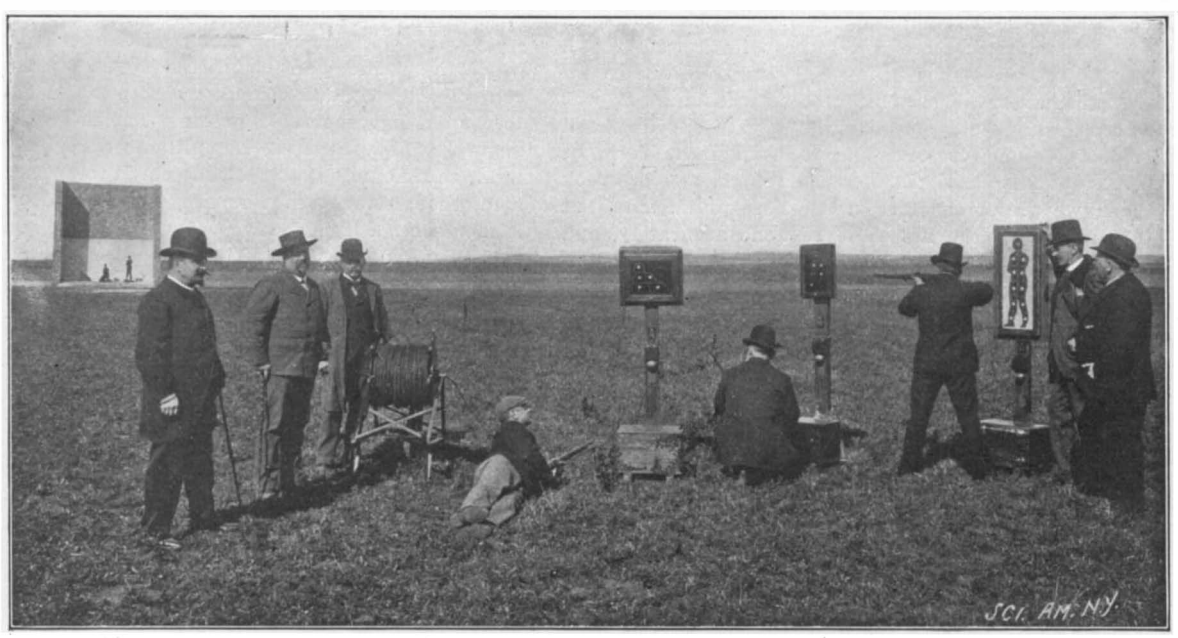


SIDE VIEW OF THE DUMMY TARGET.

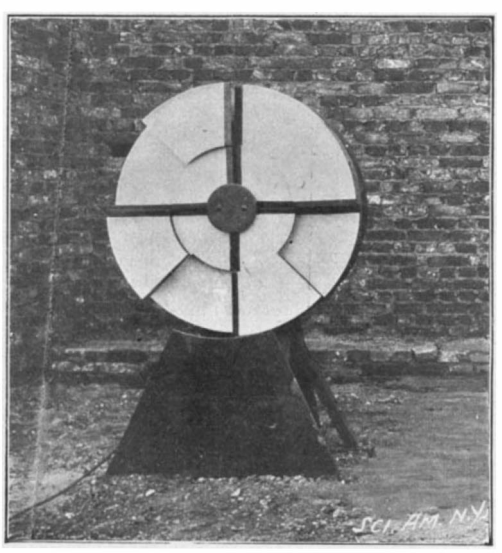
In making this back and forward movement the train broke in two eight or nine different times, on one occasion shearing the twelve 1-inch drawbar pocket bolts—so great was the power of the engine. Two hours and three-quarters were consumed in crossing over and getting back, and the train that it was intended to let by without causing any delay was delayed an hour and a half.

"We came to the conclusion," says Mr. Sullivan, "that it was quite possible to get an engine that was large enough to handle a bigger train than was practicable, as a transportation proposition, to move over the road.

"These large engines have now been in service nearly two years. We give them each trains of 1,800 tons on portions of the road where mogul engines of 19 x 26-inch cylinders handled trains of 900 tons. Each of the big engines takes a double train. The total expense of moving 10,000 tons one mile with the big engines is $1.86, as against $2.02 with the mogul. By reducing the train to a tonnage that could be handled readily, we have been able to operate the large engines successfully, having them take their turn in the service just as it comes—one day with a heavy coal train, next day with a stock train or with a banana train, making speeds anywhere up to forty-five or fifty miles an hour, and doing that without any trouble. We think that such an engine is, if anything, larger than economical locomotive practice demands, and we have purchased no more of them. We find that a mogul engine with 20 x 28-inch cylinders, carrying 200 pounds steam pressure. will take the same train over the road just as well as the engine with 23 x 34-inch cylinders. In other words, the 80-ton engine will do the work just as well as the engine which weighs 110 tons, and either of them will do better than a double-header."



THE TARGET AND THE ANNUNCIATOR SET UP IN THE FIELD.



ELECTRICAL DISK TARGET.

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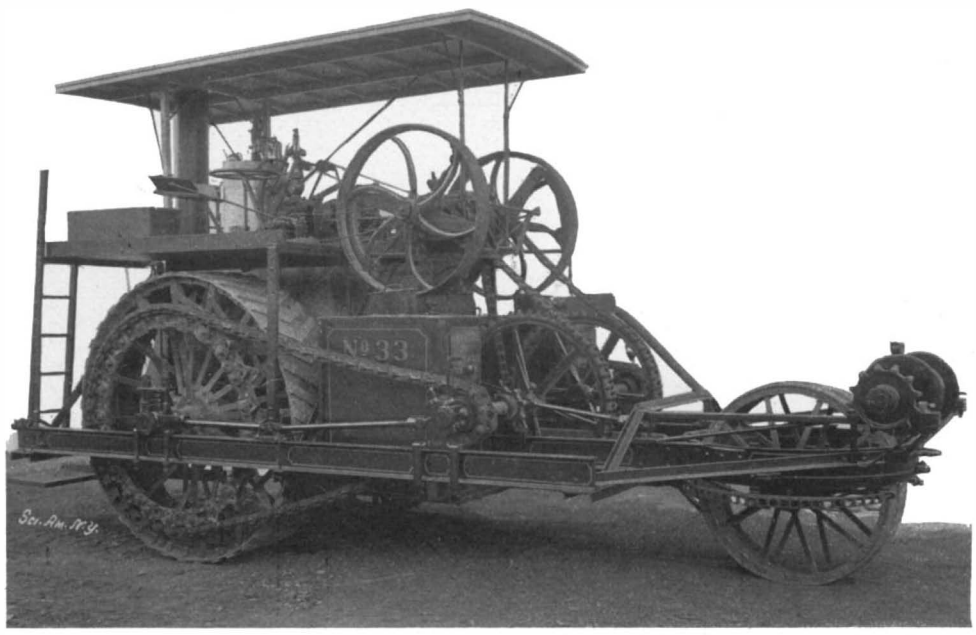
THE TRACTOR IN LUMBERING OPERATIONS.

The success which has attended the use of steam power in farming operations on the Pacific coast, has resulted in the use of the traction engine in lumbering and other industries where extensive horse power is required. The roads in the hill country of California, Oregon and Washington, where are located the principal lumber camps, are in a very crude condition, most of them having no paved surface, while the grades are extremely steep in many instances. Much of the formation is of a red clay, which in wet weather is turned into liquid mud, through which an ordinary wagon can scarcely be forced, although three or four horses or mules may be attached to it. Loose stones falling from the hillsides increase the difficulty of travel over these mountain highways, so that where animal power is used, double and treble the ordinary number of teams are required to "freight" lumber or other material from the woods to the mills or the railroad stations.

For the purpose of substituting steam power for animals, the Holt Brothers, of Stockton, the inventors of the farm tractor, have designed a very powerful engine, which accomplishes remarkable results where it has been placed in service. The sizes range from 40 to 60 horse power, and the plan of construction followed is similar to that of the farm engine which has already been described in the SCIENTIFIC AMERICAN. The driving wheels, however, have narrower tires, although they range from 18 to 24 inches in width, with corrugated or roughened surface, in order to give them more traction upon the highways. Power is communicated to the driving wheels by roller chains on each side of the truck, which revolve about an axle which is driven by two sprocket wheels, also connected by roller chains with the engine. The tractor is guided or steered by a smaller front wheel, which is connected with a hand-wheel by a sprocket chain, so that the motorman can turn it in any direction desired, merely by using the strength of one hand. Most of the engines are provided with a steel drum upon the forward end of the truck frame. Upon this is reeled a wire rope or heavy manila cable kept for the purpose of hauling when the tractor may be detached from the cars of logs or material to be transported.

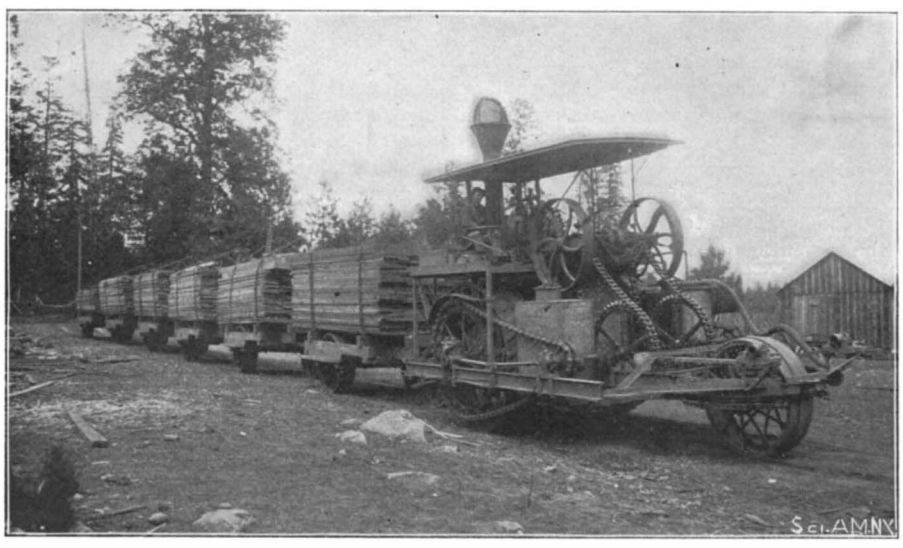
On a level surface, the motor will readily pull a train of trucks loaded with lumber weighing from 200 to 250 tons, without difficulty. On the highway it can attain a speed of from 8 to 10 miles an hour if desired. It is used, however, in the forests, where no highways exist for transporting logs from the stump lots to the mills or the railroad stations. In this case, the logs are usually chained together, sometimes mounted upon rollers, and then attached to the tractor, which pulls them to their destination by the most convenient route. Such is the strength exerted that it can actually be forced through bushes and over young trees five and six feet in height; while being able to turn in a circle of 150 feet, it can be guided in and out among the trees. It will haul in this way a dozen large trunks, a single one of which would require the strength of ten or twelve horses or mules to move ordinarily.



General View of the Freighting Engine.

The ordinary highways have such steep ascents, that frequently the tractor can reach the summit only by being separated from the trucks or cars which it is drawing. To haul its load to the top of the hill is the object of the drum and cable. The latter is unwound, fastened to the cars or trucks at the bottom, and the tractor converted into a stationary engine, exerting all its power upon the rope. In this way trips can be made over routes which are literally impassable for wagons. Another great difficulty encountered, especially in California, is sand. This is partly overcome also by the broadness of the tires, which prevent the engine, in spite of its weight, from sinking into the surface of the road to such an extent as to become stalled.

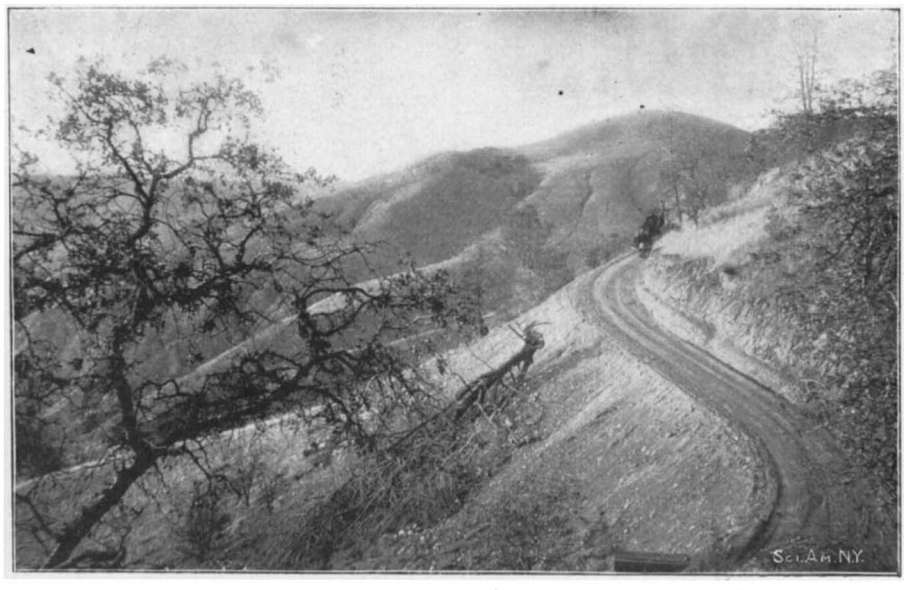
The type of tractor used especially in lumbering and mining operations is what is termed the freighting engine, and weighs from 14 to 21 tons when equipped and ready for service. It will consume about 225 pounds of coal an hour when working at its full capacity, or about one ton daily, while its consumption of water is about 300 gallons an hour. Since the use of oil in industries on the Pacific coast has extended into Oregon and Washington, some of the tractors have been fitted with apparatus for burning oil in place of coal. It is calculated that one will utilize about 28 gallons of the ordinary oil hourly when in service. The boilers furnished are of two types—corrugated-flue and water-leg. In freighting outfits a smaller force of hands is required than in farming operations with the tractor. The larger types have an engineer and fireman, if coal is used. The latter may also act as "trainman," coupling and uncoupling the cars and trucks when necessary, so that really only two men are required to transport the material. The photographs which show the tractor hauling lumber on the level, also ascending steep grades and going over sandy roads, include a view showing the manner in which it is employed in duty on the farm. As a substitute for horse drills, in planting seed, the motor has been very successful, accomplishing from twenty to thirty times as much at a time as two or three teams of the heaviest draft horses. In fact, calculations made of the economy of operating with the tractor show that it will plow and harrow, seed and harvest a certain area at about one-sixth of what it costs when men and horses are



The Freighting Engine with a Small Load.

The Freighting Engine in the Field.

Hauling a Load up a Heavy Grade.



The Freighting Engine Descending a Hill.

THE TRACTOR IN LUMBERING OPERATIONS.

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used. Lumbermen who have tested it for freighting purposes estimate that the cost is about one-third of the sum expended when teams are employed. In these estimates the fuel and water and repairs are all carefully estimated and deducted.

FIJI AND THE FIJIANS.

A TRAVELER'S OBSERVATIONS IN THE PARADISE OF THE PACIFIC.

BY SIDNEY DICKINSON, M.A., F.R.G.S., BOSTON.

Few travelers, comparatively, have penetrated the mysterious regions of the Southern Seas. Many have, indeed, wandered as far as the Hawaiian Islands, and returned enraptured with the mingled beauty and grandeur of these, our new possessions—but even there the traveler stands merely upon the threshold of the Sub-Tropical Wonderland.

Far below his horizon roll immeasurable leagues of iridescent seas; his ear cannot hear the roar of distant surf upon the coral reefs; the melting skies, the amethystine mountains, the vales "with verdure clad," lie far beyond his ken. There is perpetual summer; beauty that never fades; a year whose cycle knows no blight of frost or shroud of snow; flowers that bloom in never-fading generations; days of unbroken sunshine; nights in whose violet depths strange constellations glisten, and from whose bosom subtle perfumes emanate and intoxicate the air. Here nature wears her native and immaculate garb—virgin as she appeared on creation's morning, when the Spirit moved upon the waters, and from the womb of primeval Night brought forth these Islands of Eternal Day. Audacious the tongue that attempts to utter, the pen to record, the brush to paint the wonders of these happy archipelagoes—yet will I try to lift a corner of the veil that hides their beauties, confident of indulgence if I fail in my endeavor to describe the indescribable.

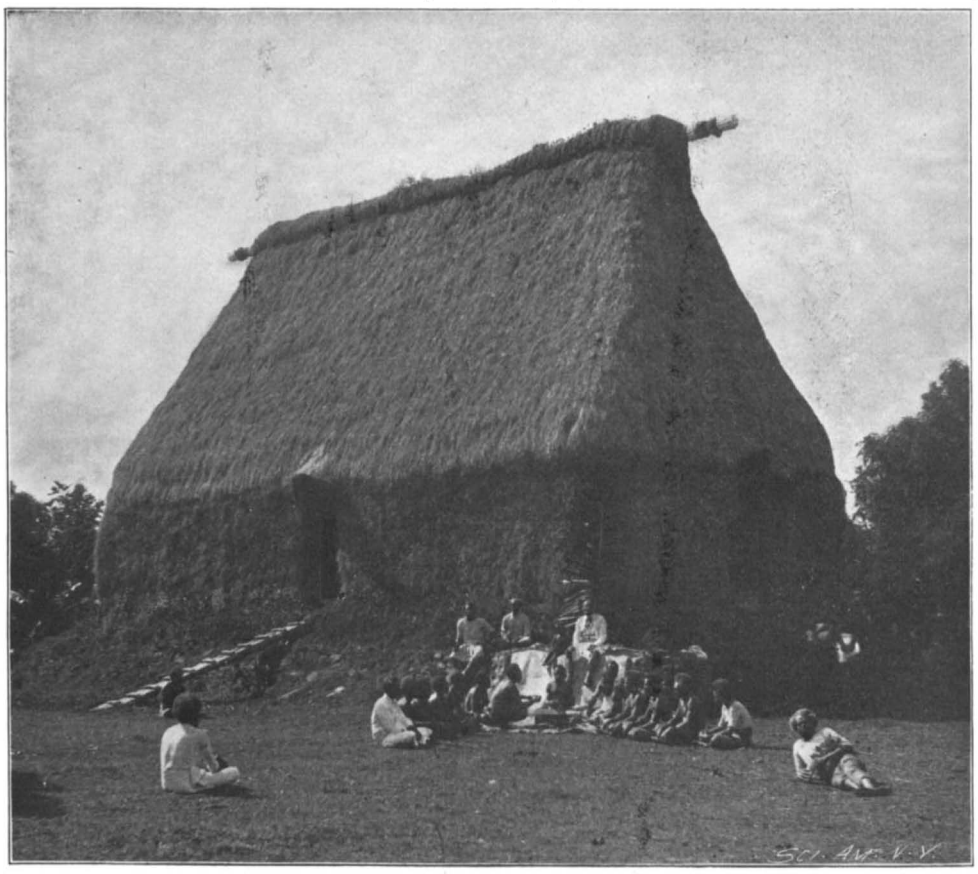
Most interesting, perhaps, of all these lands of the Southern Seas in natural charm, strange and somber history, and present importance as illustrating the work of civilization in that part of the globe, are the Fiji Islands. Upon the chart of the world they appear as mere pin-pricks amid the vast expanses of ocean that surround them—a small galaxy among the thousand systems that form that Milky Way of the Pacific known to geographers as "Oceanica." A vast continent, ages ago, may have existed here, and, subsiding slowly, have left its loftiest peaks and table-lands to stand above the waves as monuments to mark its place of burial. Cyclopean remains upon certain of the groups, whose builder no man knows, and present languages and customs seem to refer to some mighty and long-buried past. The glamor of mystery that broods about those seas is fascinating—all the more so that their secrets seem likely to be preserved inviolate until eternity solves the riddles of time.

The Fiji group, lying south of the equator at about the distance that the Hawaiian Islands lie north of it, covers five degrees of latitude and three of longitude. Forty of the islands are of considerable size, while some two hundred more are of decreasing importance, the tale dwindling to barren and uninhabited rocks hardly large enough to be christened. These islands lie in an irregular oval—300 miles in longest, and 120 miles in shortest diameter, around the Koro Sea, and, like our own West Indies, are composed of two groups, known as the "Greater" and "Lesser Fijis."

"Fiji" is a corruption of the native "Viti," which appears in the name of the largest land of the group—"Viti Levu," or "Big Fiji"—which contains an area of 4112 square miles; "Vanua Levu," or "Big Land," coming next with 2432 square miles. Roughly speaking, the total land area of the Fiji Islands about equals that of the State of Connecticut, and the population is estimated at a quarter of a million.

Travel to this land of the whilom cannibals is to-day a commonplace matter. Steamers from San Francisco make regular calls, and at least two lines from Australia convey the voyager in luxurious comfort. My own approach to Fiji from Melbourne was by the "Taviuni" of the New Zealand Union Line—a boat which was then making her first trip after steaming from her birthplace in Scotland to Melbourne around the Cape of Good Hope—a trifle of 12,000 miles—without once stopping her engines. As to one's treatment by the sea—that is a matter of luck and temperament. The Pacific has its whims, and, despite its name, I have never encountered worse weather or heavier seas than around Australia and New Zealand. When the discoverer of this sea, looking from the hills at Panama, saw its languid swell and the lazy break of its surf on the shore, he might well have thought he was looking upon the waters in their constant mood, and have had reason for calling the ocean the "Pacific." If, however, he had set sail upon it, and made test of its capricious temper, we can fancy him looking over the side of his caravel with a face of anguish, and declaring between his qualms that he was the biggest failure that ever lived in the matter of christening large bodies of water.

Early on the morning of the seventh day from Melbourne, a patch of misty blue appears upon the horizon, and by degrees the verdant shores of Fiji rise into view. Passing through the opening in the coral reef, we enter the placid harbor of Levuka—lying, like Honolulu, under precipitous hills, sprinkled with the white bungalows of the European residents. There is a strange sense of unreality in coming, in our present fashion, to the Land of the Cannibals, and the air of peace and serenity which broods over the beautiful harbor and town afford a striking contrast to the conditions that one has imagined after reading Fijian history. The former things, however, have passed away, and the stranger may now wander pretty freely over the islands, without fortifying himself with the hope that Sydney Smith urged upon his departing missionary friend—"that he would disagree with the man who ate him."



Example of Fiji Architecture—A Thatched Hut.

As we approach the shore, a flotilla of boats puts out to meet us—catamarans made of cocoanut logs hollowed out, pointed at each end, and rendered stable by wide outriggers. Natives, clad only in loin cloths, or *sulus*, of calico or snowy *tappa* cloth, paddle these craft rapidly toward us, and swarm aboard to sell their cargoes of fruit and curios—somewhat to the consternation of our lady passengers who precipitately flee to the cabin at sight of these brawny savages; but soon return, for it is not in feminine breasts to resist the fascinations of the bargain counter.

These Fijians are a stalwart race; very tall and muscular, for the most part, their skins soft as velvet from anointings of cocoanut oil, their countenances strong and in most cases pleasing, rather than forbidding. A thing that at once impresses the visitor is the varied and striking manner in which both men and women—the former especially—arrange their hair. Here a man is seen whose pate seems covered with a thick coating of whitewash; there another, whose locks, radiating in every direction from his skull as if they were electrified, could hardly be inserted in a bushel basket. The former state is but a preliminary to the second. The natives plaster their hair with a kind of paste made of powdered coral mixed with water, which, after hardening and then being broken up, stiffens the hair and bleaches it from its natural black to odd shades of red and dull yellow—thus producing strange effects in combination with the dark-brown skins of the people. Each form of head dressing has its meaning—the chiefs wear one, famous warriors another, men of counsel a third, yet all with variations at the caprice of individuals, which give great picturesqueness to a native gathering. Married men are distinguished from bachelors by the cut of their hair; the latter are of little account in Fiji, and by the way, are barbered, to announce to a scornful population their independent and degraded condition.

Both sexes are attired in the airy and simple manner which residence in a climate where the sun is hot, and the rainfall from eight to twelve feet a year, would naturally suggest. An elaborate female costume is shown in the picture of a chief's daughter, who is arrayed as to her trunk with a necklace of "trade" beads, and from her waist downward with a mantle of beautifully decorated "*tappa*" cloth, of creamy white ground relieved by designs of dull reds and browns. This "*tappa*" cloth is a characteristic product of Fiji, and is made from the inner bark of the paper-mulberry tree, which is macerated in water and the pulp beaten out upon hard ground with heavy wooden mallets, making a sort of vegetable felt of varying thickness—some as heavy as a blanket, others as light and thin as gossamer. The average female dress, however, is less elaborate—consisting simply of a fringe of cocoanut husk or hibiscus fiber dyed black and hanging from the waist to the knees. This adapts itself to every movement of the wearer, and is at once a sensible and decent dress.

Chiefs Drinking Kava.

FIJI AND THE FIJIANS.

The interior of a native house illustrates another use of the omnipresent "*tappa*" in wall

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hangings and decorative coverings of beams. Piles of the cloth spread upon the floor, make delightfully cool and elastic beds, and upon the rafters are placed huge rolls of the finer textures, which by their number and total of yards represent the family wealth. When a woman of means marries she displays her social position by winding about herself all the "*tappa*" cloth her family can muster—so that a bride from the Fiji "Four Hundred" resembles a cotton bale with her head sticking out of the middle, and has to be carried to the altar by half a dozen muscular male relatives.

At short intervals along the shore, and in the cleared spaces of the tropical jungle, are the homes of the natives—some isolated, others collected into considerable villages, but all swarming with the brown children of the sun. These houses are always wide open, and one can enter at will, the people and the visitor seeming to take an equal enjoyment in the curious appearance that each presents to the other. A Fijian house is perfectly adapted to the climate, and affords protection alike against the torrid rays of the sun and the frequent tropical deluges of rain. It is made by driving stout posts into the ground, across which are laid beams fastened to the supports by ropes of cocoanut fiber, and from this framework rafters are run up to a central ridge-pole. Roof and sides are covered with a thatch of grass and reeds, sometimes two or three feet thick, the whole structure being elevated on rough blocks of coral, thus affording freedom from the dampness of the ground. In ancient times the four corner supports of chiefs' houses were set in holes wherein captured enemies had been buried alive, while a chaste and agreeable decoration of the front would be a row of stones indicating the number of captives the chief had eaten during his career. Thus, the tales of stones of a famous chief, counted by a missionary in 1849, was 872—for which the chief apologized, saying there should have been more, but he had been indolent of late, and had neglected to post up his ledger.

A country like Fiji, with its copious rainfall, is naturally full of watercourses, and the mountainous character of the land gives opportunity for numerous waterfalls, which are among the most charming features of the islands. Nothing can be more beautiful than these silvery cascades, set, as they are, in a dense jungle of flowering trees, variegated shrubs and mottled crotons, or in ravines where enormous orange-colored spiders swing in webs that glitter like diamonds from the spray of the falls, and where the flight of the "orange" and "rainbow" doves, and crimson and green parakeets, gives movement and shifting color to the scene. The natives are a cleanly folk, and spend much time in the water of the inland streams or in the sea within the coral reefs, where the sand is of dazzling whiteness and the water shows every shade of the opal, turquoise and sapphire.

Along the edge of the sea, extending for miles on both sides of Levuka, runs a smooth and level path, which, built up on the wall of coral rock that rises a few feet above the water, leads by gentle curves around projecting promontories into avenues of palm-trees, and picturesque glades where sleepy villages drowse under the rustle and shade of the cocoanuts, and in hearing of the perpetual symphony of the waves. From this path the eye extends to the encircling coral reef, against which the ponderous waves of the Pacific burst in clouds of foam. The heavenly blue of the water inside the reef forms a beautiful contrast with the purplish-indigo expanse without, and the drowsy air is made drowsier still by the incessant reverberant roar of the distant breakers. This sound is heard nowhere else in the voice of the sea. It has no intervals, but resembles the continuous passage of a heavily loaded railroad train, the hollow, semi-elastic structure of the coral giving it a metallic, ringing quality that is as noticeable as it is difficult to describe.

If you will launch a boat at noon, when the vertical sun lights up every detail in the bottom of the shallow lagoon, you may introduce yourself to a strange and lovely spectacle. You float over fairy grottoes, looking into which, through translucent fathoms, you see coral in every tint of blue, green, pink and creamy brown—the recollection of which will give you ever after a distaste for its bleached and ghastly skeletons in cabinet or on bric-a-brac table. Through its finest of branches float armies of fish the color of topazes and rubies, and of quaint or monstrous forms; enormous purple and crimson starfish sprawl upon snowy sands, while around them the hideous (but edibly delicious) sea-slug—the famous bêche-de-mer—glides in writhing progression, and sea-urchins expand and contract their iridescent spines. Now and then you drift over spaces dusky with depth, through which enormous conger-eels pass with wavering fins, and green turtles flap like strange, unwieldy birds—while rainbow-hued shells incrust everything in wanton profusion, and add to the beauties of fish, coral and swaying weed to produce a scene of exquisite loveliness, which lingers in the recollection like an enchanted dream.

A view of Fiji would be incomplete without some illustration of the old cannibal practices which, until less than fifty years ago, made the country a section of hell transplanted to earth. Instances of this era are found most numerously at Mbau, the old heathen capital, and headquarters of the late King Thakombau (to give the English pronunciation of his name), who, as the last ruler of Fiji, ceded his country to Great Britain for a pension of £1500 a year and other considerations, and whose war-club, sent to the Queen as mark of fealty, holds worthy place at Windsor beside the umbrella of King Koffee of Dahomey—reminders to the world of two as thorough scoundrels as ever cumbered it. Before his conversion to Christianity the city of Mbau was covered with trees forming sanctuaries like the groves of Baal, and as one of his first acts on reformation was to cut these down, Mbau now lacks many interesting arboreal growths. Chief of these was the famous "Mbau Larder"—an enormous tree upon whose spreading branches tough victims were hung to acquire that "gamey" flavor which Fijians like in "long pig" (as they facetiously term the human bake-meat) and Englishmen in pheasants and grouse. The Wesleyan Mission House to-day fronts the ground where banquets were served and victims prepared for the oven. A huge stone stood at one end, upon which the subject's brains were knocked out as a preliminary; to-day it is in the church at Mbau, and is used as a baptismal font for native converts, its top having been hollowed out.

I met an aged man at Mbau who gave me much interesting information on cannibalism. His father, he said, had been a famous trencherman in the good old days, and although he denied that he himself had ever eaten the flesh of his kind, yet in the course of his description he fingered my arms and pinched my legs and poked me in the ribs in a manner which seemed to me not altogether platonic. Fijian flesh, he stated, was superior to that of white men, who tasted of the salt they ate with almost everything—while a tough old sailor was practically a waste of raw material from the tobacco and grog with which a life before the mast has a tendency to flavor the human system. Interrogated as to choice cuts, he gave the palm to the head—the brains and eyes being particularly desirable, and the cheeks, especially in young subjects, submitting to baking very kindly indeed. The upper part of the arm, too, and the calf and upper portion of the leg, were not to be despised—but, said this epicure, as for the rest of the body, "throw him away." In the afternoon this interesting savage came around for me to get my gun and go into the bush with him, where he would "show me plenty parrots." After the enthusiasm of his morning description, however, I thought it prudent to decline.

A quaint feature of Fijian life is "*kava*" drinking—the beverage being made from the root of the *angona* shrub, which, being macerated and mixed with water, ferments and forms a mild intoxicant. It tastes like soap-suds and ginger-ale mixed, and the relish for it has to be acquired. It is drunk with solemnities at meetings of chiefs and at conferences generally, and its absorption is governed by strict rules of etiquette. It must not be sipped, but swallowed at a gulp, as a Western cowboy assimilates his whisky, and it is a fine touch, and an instance of *savoir faire* after drinking to "skitter" the cocoanut-shell cup in which the beverage is served along the ground to the presiding genius at the supplying bowl. In native circles the root is chewed by women and expectorated in the bowl to be mixed with the water. This is said to give a peculiar and agreeable flavor, but the less robust white residents reduce the root by a grater.

The "*Meke-Mekes*," or descriptive songs and dances of the Fijians, are wonderfully impressive. The illustration shows a party of girls giving the "Wave" *Meke*, describing the movement of the sea on the reefs. The hands sweep the ground slowly, with waving motions of the fingers, to show the ripples crisping in the wind. Then the bodies sway in unison to show the roll of the ocean—other movements of rising and falling figures show the leap and fall of the breakers. Action grows more violent and confused, the performers rise to their knees, then to their feet; at last, with a spring and a clapping of hands, the wave is described overleaping the barrier of the reef, and as it falls into the still lagoon the dancers drop to the ground in unison with a long cry in diminishing cadence, and the "*Meke*" is over.

Delicious is the life in the tropic seas, dreamy as the lotus that typifies it—not to be understood by residents in our colder and ruder North, but delicious even in the aftertaste to him who has experienced it. Even I, who have sparingly partaken of this divine food, cannot forget its flavor; forevermore will rise before me, in smoky London, perchance, or in bustling New York, visions of the slumbering palms in the moonlight at Levuka, and my ears hear the murmur of the surf and the plaintive *Mekes* of Fiji.

Professor J. H. Sears, Curator of Mineralogy and Geology at the Peabody Academy of Science, in Salem, Mass., has unearthed in newly opened claybanks in Danvers fossils of the mollusk Portlandia lucina.

Correspondence.

Coal or Oil—An Early Suggestion from the Founder of the Guion Steamship Line.

To the Editor of the SCIENTIFIC AMERICAN:

In the summer of '79 or '80 I was crossing the ocean on the steamship "Arizona." The managing director, Mr. William H. Guion, was on board. Among the many interesting conversations with him was one upon the possible use, at some future date, of oil in the place of coal. The discussion came up on account of the vast amount of black smoke that almost constantly poured from the funnels of the steamship. The enormous amount of waste which he told me occurred from this unconsumed carbon was almost incredible. He then declared that the time would come when oil would be used in the place of coal, and gave as an interesting fact, or opinion, that the saving in freight room by the use of oil, in one trip between England and Australia, would be worth £6,000 ($30,000). Mr. Guion was a very practical, energetic, progressive man, and his line furnished the first of the ocean greyhounds. His remark was truly prophetic.

GEORGE G. ROCKWOOD.

New York, June 17, 1902.

Prizes for Photographs.

The Bausch & Lomb Optical Company, Rochester, N. Y., announce a photographic competition open to amateur and professional photographers, residents of foreign countries, as well as the United States, the object being to bring together as large and representative a collection of photographs as possible, in order that the present development of the photographic art and the progress in lens and shutter construction which has been made during the past quarter century may be made evident. It is during the last quarter century that the greatest progress in photography has been made. In order to enhance the interest of photographic work, the awards have been divided into a number of classes, such as landscape, portrait, genre, instantaneous, architectural, interior, etc. Several special awards for telephoto and other work have been provided, also a special award for users of the Bausch & Lomb rectilinear lenses on various makes of hand cameras, kodaks, etc.

The Current Supplement.

A fully illustrated article on the American cut-glass industry opens the current SUPPLEMENT. Next comes a dissertation by Dr. E. Fischer on temperature experiments with butterflies. Dr. Fischer has proved the remarkable fact that by breeding certain European butterflies at low temperatures species are obtained which probably existed in the glacial period, and that by breeding these same European butterflies at high temperatures species which never existed before are produced. The Peterson boat-launching apparatus is made the subject of an illustrated description. The compressed air cars used in France are fully described. The results of the Interstate Commerce Commission's report on safety appliances for trainmen are also published. Mr. Guglielmo Marconi in an entertaining way tells something of the practicability of wireless telegraphy. Prof. Pedersen, Valdemar Poulsen's assistant, has made an important improvement in multiplexing the telegraphone. The improvement is fully described. The wonderful Mexican istle plant and the many uses to which it can be put are fully set forth in an account illustrated by a series of very handsome pictures. The usual minor articles are also published.

An Odd Method of Heating Cars.

The Northwestern Railway Company of England has equipped some of its trains with a system of heating to which the much-abused term "unique" may well be applied. Two concentric cylinders are employed, the annular space between which communicates with a steam-pipe extending from the locomotive-boiler. The inner cylinder contains acetate of soda—a compound remarkable for its property of liquefying when heated, and of cooling very slowly. The radiators thus constituted are incased in asbestos-lined boxes having hinged doors. By opening or closing the door of a box the heat is turned on or off.

The United States Shipbuilding Company has absorbed the Bethlehem Steel Company, with the result that one of the most completely equipped and self-contained shipbuilding plants in the world has been formed. The new company is thus able to make every part of a ship, including armor plate and guns. The plant of the Bethlehem Steel Company, which is at South Bethlehem, Pa., covers an area of one and one-quarter miles long by one-quarter of a mile wide, of which about thirty acres are under cover. The works are particularly well equipped for the manufacture of armor plate and gun forgings.

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THE PACKING INDUSTRY OF CHICAGO.

BY DAY ALLEN WILLEY.

The industry of killing and packing beef, pork and mutton has reached such proportions at Chicago—the greatest center of this industry in the world—that the most modern processes have been introduced for the purpose of economizing both time and labor, as well as utilizing all of the products of the carcass. The Union Stock Yards, where are located some of the largest packing plants, are the most extensive in the world, having accommodations for nearly 125,000 hogs, 20,000 cattle and 15,000 sheep. Yearly 3,000,000 cattle and 5,000,000 hogs are slaughtered and converted into packing-house products in what is known as "Packing Town," which really forms a section of the yards. A further estimate of the extent of the industry can be gained when it is stated that the space devoted to pens alone comprises 200 acres, while the yards are traversed by 150 miles of railroad track and 20 miles of streets, and the troughs from which the live stock are fed and watered aggregate 75 miles in length.

As far as possible, machinery has been employed, with the result that one of the large companies treats 7,000 hogs in a day, where by hand less than 10 per cent of this number can be disposed of. While the killing itself is still done by manual labor, the butcher has every appliance to further his work. The drove of hogs, for example, is passed from the yards into specially-shaped pens, thence forced, single file, into a compartment where a large metal wheel revolves slowly but continuously. An attendant seizes each of the animals by one of the hind feet and fastens it to the wheel by a short chain. As it is lifted into the air, the butcher with a thrust of the knife opens the throat; the work occupies but a second. The blood from the carcass flows into a trough, which passes it on to vats, where it is kept until utilized in the manufacture of fertilizer. The carcass revolves on the wheel until it reaches a point where it is automatically removed and fastened to a trolley system which conveys it into the scraping-room. Here it passes through a machine, provided with revolving blades, which removes most of the bristles, preserving them so that they can be later made into brushes. The carcass is then passed into a vat or tank of boiling water, which softens the balance of the bristles so that they can be easily removed by hand. From this apartment it is conveyed by machinery into the chill-room, where it remains for 24 hours before being cut into sections.

The carcass, freed from blood and bristles, is now ready for the cleaver, who separates it into the hams and sides for bacon, and removes the fat, which is to be converted into lard and other products. The cutting is done so dexterously that a few minutes suffice for one man to separate the hog into the several portions. Then the hams and bacon are placed in reservoirs filled with a pickling composition, of which each company has its own formula. The other portions for provisions are placed in the salt-room, where they remain from forty to sixty days. The same length of time is required also for the hams and bacon. Following the pickling and salting processes comes the smoking, which is done in compartments where thousands of pieces can be cured at the same time.

The lard is extracted, or tried, in immense kettles heated by steam, and while in the liquid state it is forced through pipes into the packing-room, the pails and other receptacles being filled by merely opening valves connected with the pipes. It is then allowed to cool and is ready for shipment. The pork sausage is also largely a machine product, the meat being chopped into fine particles by rapidly revolving blades, and then forced into skins made of the intestines of the hog, these intestinal skins being, of course, first thoroughly cleaned by machinery. A part of this machinery, which is operated by compressed air, will fill several feet of sausage skin in a few seconds. The links are made by merely tying the skin with strings in sections a few inches in length. Before it is sent to market, sausage is usually hung in the storehouse for a few days to "season."

Except for fastening the hog to the wheel, the killing process, the cutting into pieces, and fastening the packages, the animal passes through the packing-house

Wrapping Butterine.

with scarcely a touch of the hand. Sheep are treated in a somewhat similar manner, except that the carcasses are not made into so many products. When slaughtered they are swung from the floor by chains fastened to the hind feet. The throat is opened by the single thrust of the knife, and the body is conveyed mechanically into the chill-room. It is usually kept in this department forty-eight hours, when the hide is removed, and it is cut into halves or quarters as desired. Formerly the skins were sold with the wool on, but the packers have invented a process by which the wool

Filling Lard Pails.

can be easily stripped from the hide. The wool is then cleaned thoroughly in hot water, dried and packed in bales to be shipped direct to the cloth manufacturer, the hide being sold to the tanner. The mutton intended for shipment is usually placed in the refrigerating department, which may contain 10,000 pieces at one time. Here it can be kept for an indefinite period, as the air is maintained at an even temperature by a refrigeration system which extends to all portions of the department. When the time arrives for shipment, the refrigerator cars can be run into the refrigerator compartments, and the meat transferred without exposing it to the warm air. In the modern method of killing cattle the stunning process is still retained. As the beeves are driven into the gangways in single file, men upon elevated platforms knock them senseless by a blow between the horns with a heavy hammer quite similar in shape to the implement used in spiking railroad ties. As the animal falls a door in the side of the gangway is opened, allowing the carcass to slide to the floor below, where it is slaughtered. Here the transferring machine is attached to the body, and as fast as an animal is killed it starts on its journey through the several departments. First comes the chill-room, then the compartment where it is skinned. While one man is removing the hide, another cuts off the head and removes the tongue, and another the feet. Next it is halved or quartered in the cleaving-room, and cleaved ready for shipment to the centers of consumption, either in this country or abroad. The carcasses are usually left in halves, being transferred to the cold storage department, where, like the sheep, they may be kept an indefinite period.

The beef affords a much greater variety of products than either the sheep or the hog, although, as already stated, every portion of the animals is put to some use in the modern process. The fat, boiled in large kettles, is resolved into oleo and stearine, oleo, or oil of the beef, forming the basis of butterine and oleomargarine. This and stearine are utilized in some of the soaps which are now manufactured. The blood is converted into fertilizer, and also into buttons of a cheap grade, which are now manufactured in Packing Town, within a short distance of the slaughter-houses. The hoofs, of course, are converted into glue. In the fertilizer compound, practically all of the offal of the beef can now be utilized.

Within three or four years the manufacture of soaps and liquid foods has been undertaken on a very large scale in connection with the Chicago packing industry. Scores of products which have beef for the basis are distilled, refined and placed in bottles and jars in plants adjacent to the packing houses. The principal concerns of Chicago manufacture their own cans for liquid and solid products, and own the factories for making boxes and barrels, while one company operates a mill for making bagging for hams. As 100,000 packages may be filled in a week with liquid and solid food, the economy of this plan is apparent. Even in the preparing of what is known as canned corned beef the tins are filled with the cooked meat by machinery, the contents of each package being molded so that they fit to a nicety. After filling and soldering, the package is placed in boiling water, then a hole is made in the top to allow the gas to escape, and it is resoldered, keeping the contents in good condition for a period of years in any climate.

The trolley system is being used not only in the abattoirs for transferring the carcasses, but for the general transfer of packages and cars from one point to another. The electric motor hauls everything, from a truck to a railroad car. The method used for transferring the carcasses usually consists of an overhead bar or rail, along which the trolley is moved, taking its current from wiring or a feedbar. To the trolley are attached short chains ending in hooks, so that the animals can be easily fastened to it. The "hog-killing wheel," as it is termed, also revolves by electric power.

Mrs. George E. Hobbs, of Bridgeport, Conn., recently secured a patent on a car truck which enables trains to round curves without lowering the speed, and also permits the substitution of a broken wheel without the necessity of running the car into a repair shop. The invention was recently inspected by two representatives of the Manhattan road of New York.

Cutting up Hogs.

Pulling Wool.

THE PACKING INDUSTRY OF CHICAGO.

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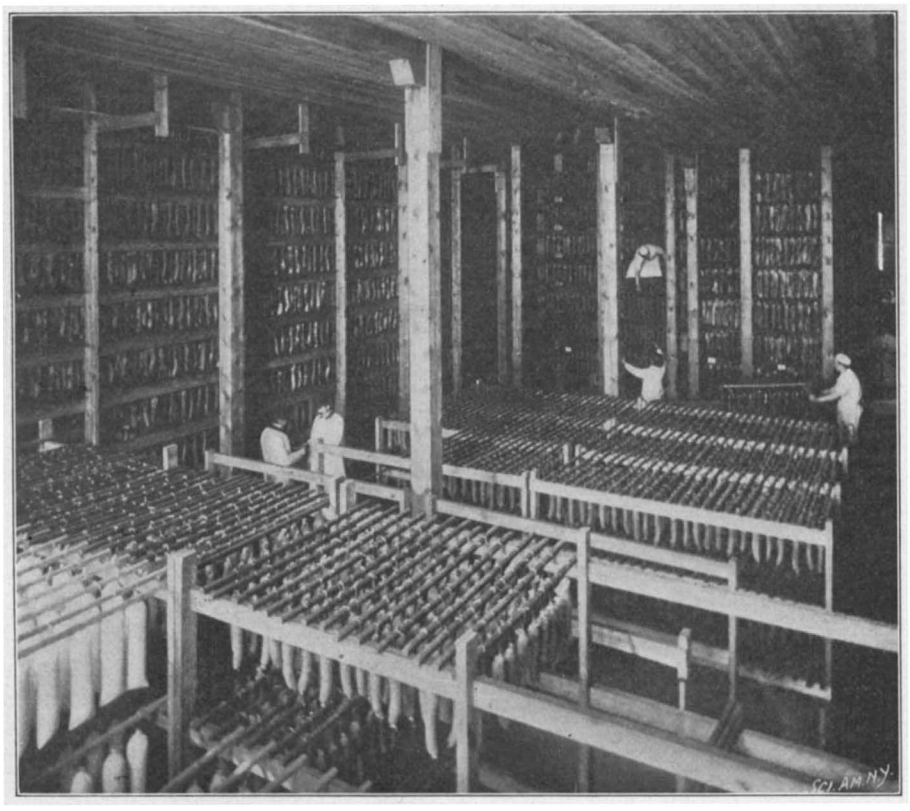
Export of American Horses.

BY GEORGE E. WALSH.

The revival of the horse does not necessarily mean a decline in the popularity of the bicycle, automobile, and trolley. These latter will go on independently of our four-footed beast of burden, and the latter, it may be said, will have his day again in spite of harnessing all the agencies of nature for performing the work of man. Wars and rumors of wars stimulate the demand for horses and mules, and in times of peace new forms of sport and pleasure introduce ways of utilizing them. The world to-day appears to be suffering a horse famine, and the heavy drafts made upon the resources of this country contribute largely to the steadily advancing prices for good horseflesh. England has been an excellent purchaser of our horses and mules for her South African campaign, where the animals were killed off by insects and the climate so rapidly that it seemed as if a sufficient number could never be shipped there to keep the army in the field well equipped.

In Europe to-day not a single country raises enough horses to meet its own actual demand in times of peace, and the facilities for breeding and raising horses are growing poorer every year. There are few good grazing lands and stock-breeding farms in Europe where horses can be raised on a large scale, and consequently this country becomes more and more the land for keeping the European armies supplied with their proper complement of horses and mules. In recent years the American trotters and fine carriage horses have become important factors in the export trade, and whereas a few decades ago such a thing as an American horse was hardly to be found abroad, to-day we have a steady stream of them going to all the European centers. Not even Russia has hesitated to avail herself of our best blooded stock, although for years the Orloff strain of trotting stock held complete supremacy in the minds of the Czar's patriotic citizens. But loyalty to a ruling house cannot forever last, and the best thing the Russian horse lovers could do was to import American stallions for crossing with their Orloff breed, and then get a few American breeders and trainers to go over and show them how the Americans did it. So we have to-day not only American horses and trotters in abundance in Russia, but American trainers and breeders practically in control of the royal stables and stock farms. Each year a good-sized consignment of the best American trotters go abroad to add new blood and speed to the Czar's stock.

Germany next to England is probably one of our best European customers for horses, and there is a steady, healthy demand from that country that promises to continue and develop indefinitely as the years go by. The American trotting horses at the Vienna race tracks are not only features of the exhibitions, but they capture a large percentage of the prizes. There is no better way to advertise American horses and methods of training than to take a few of them abroad and enter the races in competition with the European horses. France became so jealous of our success in this line on her native soil, that she practically prohibited foreign horses from entering the races. In fact, to-day very few French races are open to horses from other countries, and the French sportsmen have this show practically all to themselves; but unfortunately for them the small glory attached to a restricted competition of this character makes it almost an empty honor. However, a good many French horsemen are purchasing American trotters, and in a roundabout way getting the American horses to the front in the home races. In time it will be necessary for the sake of the sport to open the races to more general competition. A good many American horses are sent to Belgium, and then they are taken across to France, and within a very short time appear on the French turf as home-bred horses.



A Sausage-Drying Room.

Italy, Denmark, and Holland are good buyers of our trotting horses, and the annual shipments to these countries are considerable, while far-off New Zealand and Australia make small drafts upon our resources. To see that these American trotters exported are as represented, the National Trotting Association has export offices in a number of our seaports to issue certificates of pedigrees and identity to the high-grade horses shipped. This is to prevent fraud, and thus injure the American horse trade in foreign countries, and it was first suggested by the European trotting associations. Several thousand certificates have been issued to high-class racing stock; but these do not include the trotting-bred roadsters or fine carriage horses.

In this export trade of American horses not a little attention should be directed to the American breeding methods and training. It is pretty generally recognized that our trainers and methods are superior to those found abroad, and we are to-day busily engaged in exporting trainers as well as racing horses. Most of the best European stables have American trainers connected with them, and American methods of breeding and raising the best stock are adopted. No better testimony to our national efforts in improving the horse is needed, and it partly accounts for a good deal of our success in supplying the world with the finest and fastest horses.

Mountains and Hail.

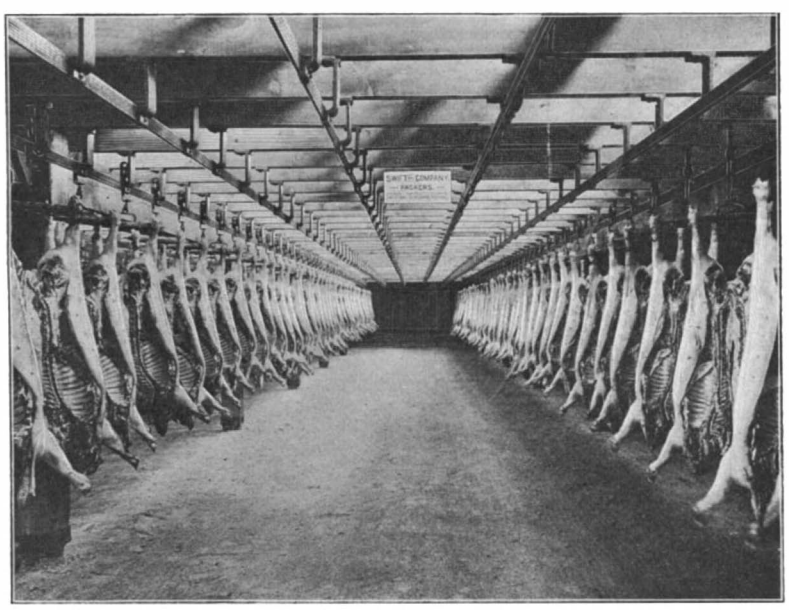
The influence of mountains on the fall of hail has frequently been the subject of controversy, but up to the present time no certain conclusion appears to have been arrived at. The Italian Meteorological Office has recently published an interesting note upon the question by Prof. V. Monti. The positions chosen were perhaps the most suitable for the purpose of any among the Italian network of stations, viz., the Collegio Romano and Montecavo, an isolated station near Rome, situated at an altitude of about 1,000 meters; the complete observations at both stations, for the years 1880-87, are contained in the Annals of the Italian Meteorological Office. During this period, forty-one days of hail were recorded at Rome against eighty at Montecavo; the monthly values show two maxima, in April and October, and two minima, in July and December, as regards the excess of days of hail at the mountain station. A comparison of days of thunderstorms shows, on the other hand, that there were 76 such storms at Rome, against 29 at Montecavo. This seems to show the excess of hail at the mountain station is not attributable to a greater intensity of atmospheric electricity. The author gives a table showing that the monthly mean temperature at Rome is at times about 10 deg. higher than at Montecavo, and suggests that the fusion of hail traversing a warmer stratum of air may account for the smaller amount at Rome.

The Louisiana Purchase Exposition authorities have offered a prize of two thousand dollars for the best design for an emblem. It may be either in relief or color, but if color is used symbolically, red, yellow, blue and white should be selected, as these are the colors involved in the national flags of the countries in which ownership of this territory at various times has been invested. The design must be one which will be available for letterheads, medals, posters or for any purpose in connection with the dignified exploitation of the Exposition.

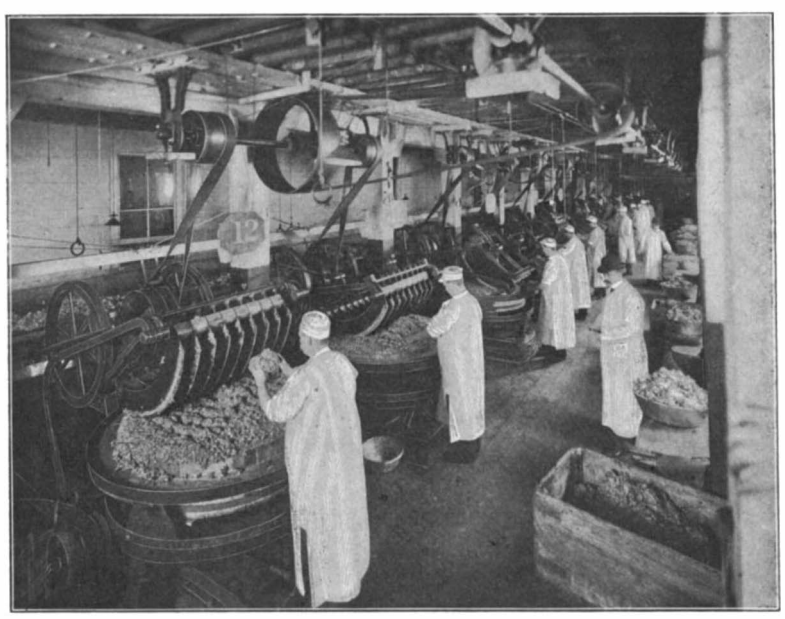
Marconi's Improvement.

In a lecture at the Royal Institution, June 12, Marconi announced that he had made important improvements in coherers. He said his new invention, which is a magnetic detector, rendered it perhaps possible to receive several hundred words a minute. At the present time he could read thirty words a minute.

In commenting on his February experiments, when readable messages were received aboard ship 1,551 miles from Cornwall, and signals were transmitted to a distance of 2,099 miles, Marconi stated that at a distance of over 700 miles signals transmitted by day failed utterly. Those sent at night, however, remained strong up to a distance of 1,551 miles, and were even decipherable at a distance of 2,099 miles. Marconi explained this peculiar phenomenon by diselectrification of the very highly charged transmitting elevated conductor when operated by daylight.



Dressed Meat Hung in a Storage Room.



Machines for Making Sausage-Meat.

THE PACKING INDUSTRY OF CHICAGO.

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THE GRISSON CONTINUOUS-ALTERNATING CURRENT TRANSFORMERS.

BY A. FREDERICK COLLINS.

The evolution of the circuit-breaker or interrupter for induction coils has been slow, owing to the lack of commercial utility of large coils prior to the introduction of the X-rays as an accessory in surgery. After Roentgen's great discovery, an impetus was given to the art of constructing induction coils and the necessary device with which to operate them, and this was greatly added to upon the advent of wireless telegraphy.

Probably the first attempt to make and break the circuit of a primary coil, by which alternating currents would be induced in the secondary coil, was by sliding one terminal of a copper wire over a coarse file. Sturgeon, the inventor of the electromagnet, exhibited his coil in 1837 equipped with this primeval device. Various forms of mechanical contact breakers were then constructed, by means of a ratchet and spring, and operated by hand.

These finally gave way to forms better adapted for the purpose, one of which was the revolving contact breaker of Barker, who employed a star-shaped wheel or spur to dip in mercury.

Dr. C. S. Page invented the first automatic contact breaker, which he described in 1838. Wagner and Neef improved upon the mercurial breaker by constructing one operated automatically and having the vibrating armature arranged with platinum points where the break took place. This simple electro-mechanical arrangement is now used on all coils of small size. From that time to the discovery of the X-rays many different forms of contact breakers were designed to give a long make and a short break, but no very wide divergence in the design or construction of interrupters was made until the mercurial turbine and Wehnelt electrolytic interrupters were brought out. In the former, a hollow spindle containing a steel worm, when revolved, draws the mercury from a well below up to two diametrically opposite, lava-tipped steel tubes, by centrifugal force; it is then projected against a pair of sheet-iron sectors, where the circuit is completed. In this way the interruptions may be varied from 10 to 10,000 per minute.

In the electrolytic interrupter 1,000 to 10,000 per minute. It consists in its usual form of a small surface platinum anode and a large surface lead cathode immersed in a solution of one part of commercial sulphuric acid and five parts of water. When connected in series with the primary coil or inductor, bubbles of a non-conducting gas are formed on the anode by electrolytic action, and bursting, complete the circuit. In wireless telegraphy it has been found that continued working produces a heating loss of more than three or four amperes, and forty or fifty volts—the E. M. F. required to operate it—are used.

In the mercury turbine interrupters, especially of foreign manufacture, the deposits require frequent cleaning of the apparatus, and this has called forth fresh effort on the part of inventors to introduce a form that would eliminate the objectionable features and retain the good qualities of both. This is the purpose of the Grisson transformer.

In the SCIENTIFIC AMERICAN of December 28, 1901, I described the wireless telegraph system designed by Dr. A. Slaby and Count d'Arco, and which is now manufactured by the General Electric Company of Berlin. This company has recently placed on the market a substitute for the electrolytic and turbine interrupters in the form of the Grisson continuous-alternating current transformer, shown in the engraving and diagram. This apparatus changes a direct continuous current into a pure alternating current, hence its name. Its periodicity or frequency of alternation may be varied from 900 to 6,000 per minute, and, though this is less than in the electrolytic and turbine forms, currents of any amperage may be easily employed. Different from other interrupters in the Grisson transformer, there is no interruption of the current at the maximum value, and consequently there is particularly no sparking of the brush, B^3, at U^1U^2. The use of heavy currents for feeding the inductor is thus made possible, besides reducing the size of the condenser in shunt with the interrupter, if not dispensing with it entirely.

Referring to the diagram, Fig. 2, it will be observed that in the development of this system the inductor or primary coil, $P^1P^2P^3$ (the secondary coil and iron core is not shown) has besides its principal terminal, which is common to all induction coils and transformers, a leading-in wire, L, joined to the middle convolution of the inductor at P^3. The terminals, L and L^1, are connected directly to the source of energy. By means of a shunt from the leads, L and L^1, current is supplied to a small motor, M, of which C is the commutator and R a variable resistance, whereby the speed of the rotating transformer or contact disks, V^1V^2, may be varied between comparatively wide limits.

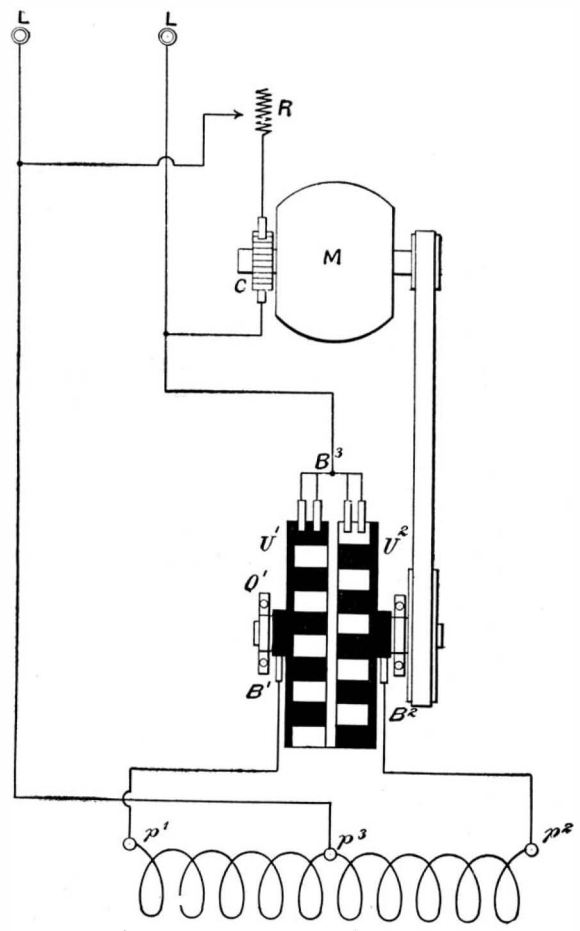

Fig. 2.—DIAGRAM OF TRANSFORMER.

The main current from L^1 is divided at the brush, B^2, on U^1U^2, which alternately make and break contact on the commutator segment of the contact disks; these disks, U^1U^2, are fastened on a common shaft, but are isolated one from the other and send forth two continuous currents from the leads, B^1 and B^2; the brush, B^3, on the opposite side slides interchangeably on the *lamella* or thin layers of V^1V^2, or temporarily unites them as the case may be. The shaft upon which the contact disks are keyed is fitted with a pulley and is driven by the motor, M, belted to it.

The principle of the Grisson transformer will now be easily understood. The current is transmitted to the inductor, p^1p^2, directly from the continuous flow for the length of time the brush, B^3, rests on the metal segment and the insulating segment of the contact disks, and the circuit, including the source of energy and the inductor, is thus closed, and the maximum value of the current is therefore effectual; but the instant this critical value is reached, the contact disks will have reversed the flow of current and p^1 and p^3 is cut off. As both portions of the inductor have a common iron core, i. e., the same core, and are magnetized in an opposite sense, a counter-electromotive force is produced by means of isolating the current, p^2p^3, in the first current circuit when the primary current strength is lessened, and as the beginning of one segment approaches and the other leaves the brush, B^3, the value of the current is brought to 0.

At the moment the first circuit is interrupted, the current quickly reaches a critical maximum value in p^2p^3. This is accomplished by the automatic closing of one or the other circuit, or both, at the same time by the contact disks, which, as the illustrations show, are arranged like a continuous-current dynamo commutator, except that the metal segments are insulated by insulating segments of equal peripheral width instead of thin sheets of mica.

The General Electric Company (Berlin) recommend this type of transformer especially for their standard station wireless telegraphy sets and the equipments they supply for armored war vessels.

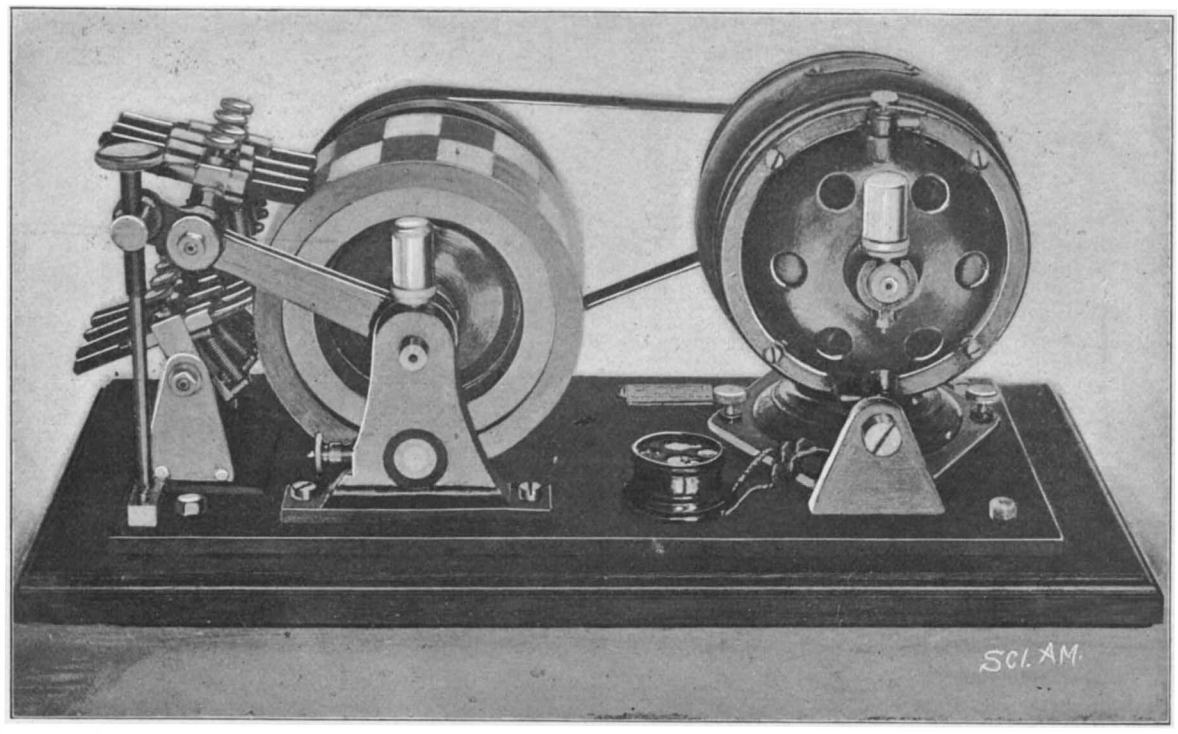

Fig. 1.—GRISSON CONTINUOUS-ALTERNATING CURRENT TRANSFORMER.

Ozone for Sterilizing Water in Germany.

Ozonized air has long been known to be a very efficient sterilizer for water, although the dry gas has been found to possess little bactericidal power. Its use has, therefore, been suggested for the purification of potable waters, but the early experimental installations, which were erected at Blankenburg, Oudshorn, and Paris, are reported to have been abandoned, and, at present, the process is only known to be in operation at Lille in France, at Bole in Mexico, and at Moscow in Russia. The method is a simple one, but hitherto the cost has been a considerable factor against it. One of the London water companies is at present conducting experiments with a view to introducing the process there. Considerable interest, therefore, attaches to the publication of details regarding the working of the small experimental installation which was erected by Siemens & Halske, at Martinikenfelde, near Berlin, in 1898.

The ozonizers employed here are of the Siemens & Halske plate and tube type, and yield from 20 to 25 grammes of ozone per E.H.P. hour, with an E.M.F. of 12,000 volts. Air is first forced through a drying chamber, and then passes into the ozonizers, on leaving which it contains from 2.5 to 3 grammes of ozone per cubic meter. It is then led to the base of the sterilizing tower, a square structure packed with flints, and as it rises through these, it meets a descending stream of the water to be sterilized, which has undergone preliminary filtration through sand. The plant in question is capable of treating 240 cubic meters of water in 24 hours (1 cubic meter is equal to about 220 gallons), and the results of the exposure to ozonized air will be seen from the following tests made with water from the River Spree. With a consumption of 2 grammes of ozone per cubic meter of water, the number of bacteria per cubic centimeter was reduced from 600,000 to 10; the permanganate absorption figure was diminished by 18 per cent, and the aeration of the water was increased from 10 to 12 per cent.

The capital outlay for an installation capable of treating 150 cubic meters of water per hour is estimated to be $33,750, of which total the ozonizers and sterilizing tower absorb $18,750. The actual cost of treatment for a plant of this size is given as 1.736 pfg. per cubic meter, and the total cost, including interest and depreciation, amounts to 5.031 pfg. per cubic meter, the latter figure being equivalent to about $55 per million gallons. In addition it may be noted that Siemens & Halske have recently patented a method of clearing turbid water by the combined action of ozone and iron.

Trial of a Motor Fishing Boat.

The first completely equipped motor fishing boat has recently made her trial trip most satisfactorily at Lowestoft. This is the first fishing craft which will rely upon petrol to generate the force required for all purposes—hauling her nets, hoisting sails, working the capstan, and driving her pumps. The motor is of 24 horse power, and is fitted in a case 4 feet by 2½ feet. It is only 3 feet high, and the top cover serves for a table. The motor is of the three-cylinder, two-cycle type, and self-starting and reversing.

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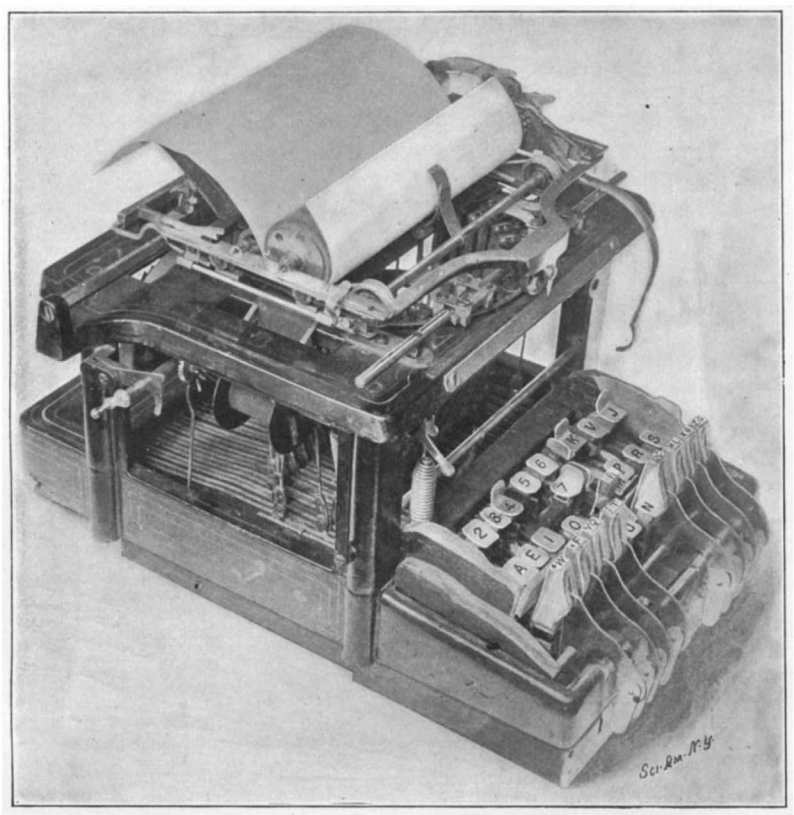
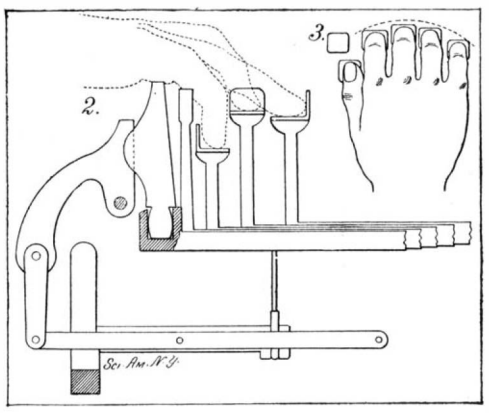
NEW TYPEWRITER KEYBOARD.

Notwithstanding the great number of inventors who have concentrated their minds on the improvement of typewriters, one important field for invention seems, up to the present time, to have escaped all. It has



1.—KEYBOARD CONFORMING TO THE ANATOMY OF THE HAND.

evidently been taken for granted that the present arrangement of the keyboard was the very best, and no study has been devoted to this part of the machine. Now comes forth an inventor from Cuba with a keyboard radically different, which is so arranged as to conform to the outline of the hand, as clearly shown in Diagram 3. The front tier of keys is adapted to be operated by the first or second phalanges of the thumbs or fingers, while the other two tiers, which



2.—THE PHALANX MECHANISM.
3.—OUTLINE OF THE TIERS.

are curved to the shape of the hand, are operated by the finger-tips. Each finger-tip operates two keys, the upper tier being engaged when the finger is distended, and the lower tier when the finger is bent at the first joint. L-shaped guides are provided on certain of the keys, to enable the more clumsy digits to instinctively find their proper locations.

A very important feature of this keyboard is the peculiar construction of the front tier, whereby each key is adapted to print either of two characters. This construction is shown in Diagram 2, and it will be seen that each phalanx-piece is directly connected by a socket joint to one of a pair of key-levers, and indirectly connected to the other key-lever by secondary levers and links. Operation of the latter mechanism is accomplished by drawing the phalanx-piece backward. A slot in the phalanx-piece receives the upper end of a curved lever, which is so connected by a link to a secondary lever below that any backward movement of the phalanx-piece will result in the depression of the latter lever. Thence connection is made to the proper key-lever above, but not directly, for the depression would be insufficient for the purpose. A third lever loosely pivoted to the front of the machine is connected near its center to this secondary lever and at the end to the key-lever. By this arrangement the leverage is increased and proper depression can be made to operate the type-bar. The directly-connected key-lever is operated by the mere depression of the phalanx-piece. and we, therefore, have an effective mechanism for operating two type-bars by the manipulation of a single key.

A very complete keyboard is thus afforded, which comprises but three tiers of keys, and which is further augmented as in the standard machine, with a shift mechanism for obtaining the upper-case characters. This keyboard can be easily applied to nearly all the typewriters now on the market and a few lessons will teach anyone to operate the machine rapidly. Great speed may be obtained, for every digit is brought into play, and each finger, with the exception of the thumbs, has four distinct movements, each of which produces a different character. The possibility of printing a wrong character is remote, for the hand is not moved during the writing, even for printing capitals or spacing, and each finger is continually in engagement with its individual set of keys. A typewritist can therefore perform his work without looking at his machine. Patents for this keyboard have recently been granted to Mr. Juan Vidal, care of his agent, Delgado de Lemos, 44 W. 10th Street, New York city.

A RECENT REAR-END COLLISION ON THE NEW YORK CENTRAL RAILROAD.

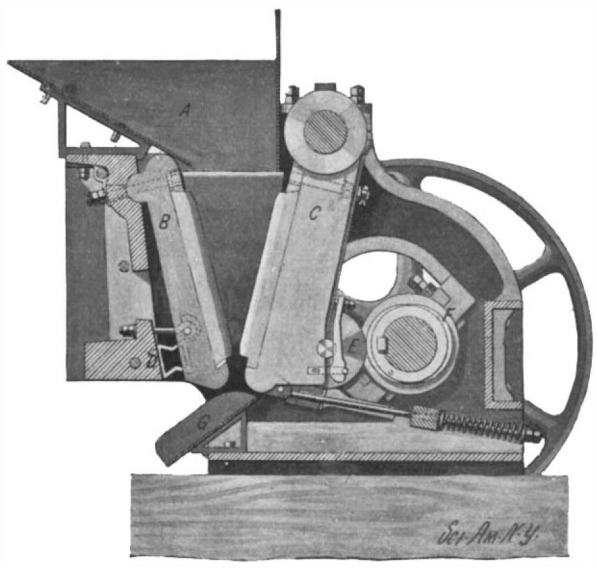
A collision similar in its effects to the horrible tunnel disaster in New York city last January, occurred on the New York Central Railroad at Peekskill early on the morning of June 14. A passenger train standing at the station, luckily having two trailing empty passenger cars, was run into at the rear about 3 o'clock in the morning by a night fast freight train. Either the engineer or fireman failed to heed the block signal set against them, or the block signalman failed to set the signal, about which no explanation is given. Had the rear cars contained passengers there would have been a great loss of life.

As it was, the freight engine plowed right through the passenger car, the roof sliding over the top of the engine, as shown in one of the illustrations, the sides of the car also passing over the sides of the engine. The other illustration shows the effect of the concussion in telescoping the following freight car with the tender. The car being filled with soft material prevented serious damage to the tender. Strange to say, neither the freight locomotive engineer nor fireman was seriously injured.

The collision emphasizes the need of automatic safety appliances for stopping trains when signals are ignored.

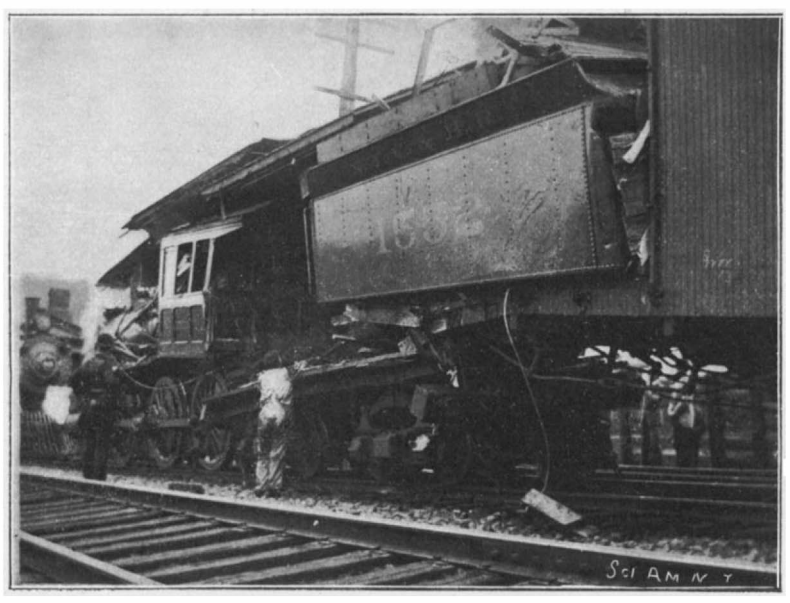
CRUSHER.

Mr. Alexander G. Morris, of Tyrone, Pa., is the inventor of a new crusher which we show in sections in the accompanying illustration. The machine is designed to crush rock, ore and other like material, which is broken into fine particles between powerful jaws operated by suitable mechanism. The material to be crushed is poured into the feed hopper, *A*, and falls between a series of open jaws, *B* and *C*. The jaws, *B*, are stationary, while the jaws, *C*, are oscillated toward and away from the jaws, *B*. Each jaw, *C*, carries a roller wheel, *E*, loosely mounted therein and adapted to bear under spring tension

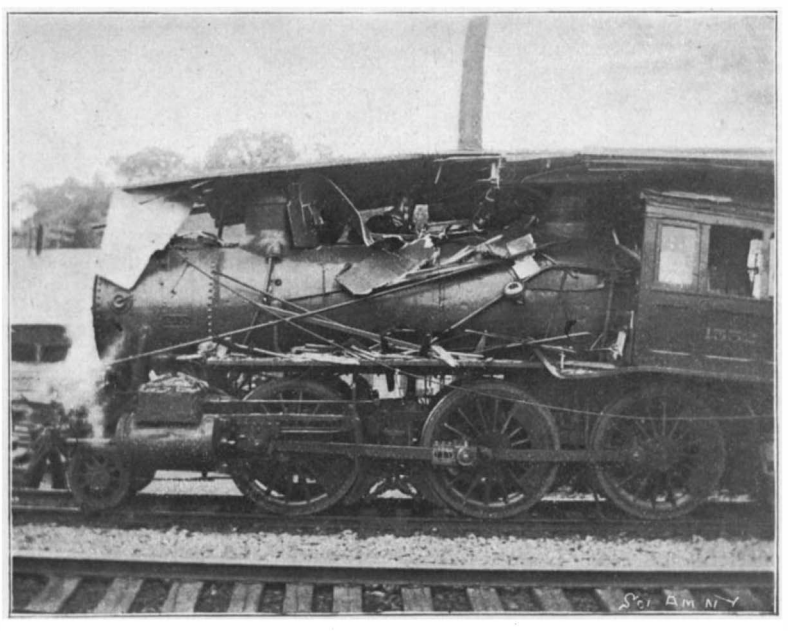


SECTION OF AN ORE-CRUSHER.

against the periphery of its respective cam, *F*, on the main shaft, thus imparting an oscillatory motion to the jaw. The ore is thus intermittently crushed and allowed to drop between the inclined jaws until sufficiently reduced in size to permit of its falling onto the chute, *G*, arranged to direct the crushed rock toward the front of the machine. Each jaw is provided with a wearing surface which may be readily removed, when worn out, and replaced by a new one. The jaws, *B*, are provided with transverse extensions which are held in corresponding cavities in the frame by bolts slightly movable therein to permit the jaws to swing. The proper inclination of the jaw, *B*, is maintained by hook-bolts working in connection with spacers, *D*. By placing spacers of various sizes in position, the jaws may be regulated to crush ore to different degrees of coarseness. Furthermore, the spacers act as safety devices to prevent the destruction of the machine by overloading it, for they are made of such strength as to stand the strain of the load which it is desired they should bear. If the crusher be overloaded, these spacers will fracture and give way, thus relieving the machine of its strain, and preventing the destruction of other and more expensive parts of the apparatus.



TELESCOPED TENDER AND FREIGHT CAR.



THE LOCOMOTIVE THAT CAUSED THE WRECK.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

DEVICE FOR LOADING CORN-SHOCKS. W. A. Tea, Bellevue, Ohio. This device, which is wheel-supported, is adapted for attachment to the rear of an ordinary farm wagon for the purpose of automatically carrying the shocks from the ground up an inclined track to the wagon bed and delivering them therein, thus facilitating the gathering of shocks adapted to be transported to husking and shredding machines.

COTTON-CHOPPER.—F. M. and L. E. Sharp, Partridge, Okla. Ter. The machine belongs to that class of machines which are adapted to be drawn over a drilled row of cotton plants for chopping out portions of the crop, thus leaving the plants in bunches or hills. This invention comprises a new construction whereby the cutter is adapted to rotate when in action and may be set at different depths or thrown up entirely out of action.

Apparatus for Special Purposes.

GAS-WASHER.—Paul Riecke, Dessau, Germany. The gas washer belongs to that class known as "standard" washers, in which several wheels or disks are arranged on a common shaft revolving in a cylindrical casing, the lower part of which contains the washing liquid. The object of this invention is to get a maximum amount of washing surface in a minimum amount of room while leaving a perfectly free passage for the gas and, at the same, to clean the washing surfaces while the apparatus is working.

WEIGHT AND PRESSURE RECORDING APPARATUS.—E. McGarvey, Bellefonte, Pa. It is a recognized desire by scale manufacturers and users to have an attachment by which the weight as indicated on the scale beam may be quickly and accurately recorded, thus avoiding mistakes liable to be made by the weighman and supplying a correct record for verifying his weights in case of dispute. Such an apparatus is provided in this invention.

TAPPING-JACKET. — M. Barrett, Grand Forks, Canada. The jacket is used in connection with the tap-hole in metallurgical furnaces. The object of the invention is to circulate cold water or some other cooling fluid around the tap-hole for the purpose of preventing the same from becoming unduly heated.

Electrical Apparatus.

TELEPHONE-CALL FOR PARTY-LINES.—W. A. Williams, O. L. Ingram, and J. B. Wilson, Walla Walla, Wash. This system belongs more particularly to that class wherein several stations are located on the same circuit. The operator at the central station may call any desired station on a party line by depressing the usual form of push button a proper number of times. This signals the station required without sounding a call at any other station on the line The duration of each depression of a push-button as it is ordinarily given at central is sufficient to operate this machine.

Engineering Improvements.

TRAIN AND SIGNALLING APPARATUS.—W. A. and B. S. H. Harris, Greenville, S. C. Two patents have been granted to these inventors for improvements on a previously patented invention in train-signalling apparatus, whereby signals were transmitted to the engineer through a slight reduction of pressure in the train pipe without the necessity of using a separate signal pipe. In the present inventions the system is simplified and made more certain and efficient. Means operated by the exhaust are provided for intercepting the air passing through the signal valve to the whistle, so as to prevent the whistle from sounding by any operation of the engineer's brake valve in the application of the brakes.

Hardware.

WRENCH.—W. M. Treglown, Sr., New York, N. Y. The improvement relates to pipe wrenches, and its object is to provide a wrench arranged to permit of quick and convenient adjustment for gripping large and small articles and turning the same in either direction.

CUTTER.—F. L. Levy, Duluth, Minn. The cutter is particularly adapted for use by dressmakers for cutting cloth in strips to form ruffles and the like. It consists of a transversely extending bar in which are arranged, side by side, a number of pins carrying rotary cutters at their lower ends.

CHEESE-CUTTER.—W. J. Spillman, Pullman, Wash. The invention relates to a device for carrying cheese and for facilitating the work of slicing it in regularly formed pieces. The device is particularly adapted for use by retail merchants.

Machines and Mechanical Devices.

PAPER-STOP.—H. F. Dunbar, Turners Falls, Mass. The device is arranged for use in connection with paper or other material while winding on a drum, the object being to produce a simple stop to permit the paper from sliding endwise off the drum, or from sliding one layer upon another. The stop may be readily adjusted to the increasing size of the paper roll while the winding drum is revolving.

FIRE-ESCAPE.—J. and P. J. Setbacken, Cynthiana, Ind. This fire escape belongs to that class in which a line or rope is provided for the descent of a person. The rope is used in connection with certain governing mechanism for causing it to be paid out at a uniform rate.

BURNER.—H. C. Zenke, New York, N. Y. In burners for linotype melting pots, as heretofore constructed, reliance is had on pressure of the gas to draw sufficient air into the mixing chamber to form the blue flame at the tip of the burner. But as soon as the pot is heated to the desired degree, and the gas partly shut off, very little, if any air, is drawn into the mixing chamber and a poor flame at the tip is the result. To avoid this difficulty, Mr. Zenke employs an air-inlet for the mixing chamber and an independent inlet for a combustion chamber under the pot to insure a perfect burning of the gas and consequent proper heating of the pot at all times.

SKYLIGHT-OPENER. — G. Bickelhaupt, New York, N. Y. This skylight-opener is easily manipulated and may be opened a desired distance for ventilating or other purposes, and after this adjustment is made, means are provided for locking the skylight in place.

FRICTION GEAR.—E. P. Dawson, Butte, Mont. The friction gear is peculiarly constructed for variable speed and is adapted particularly for connection with sewing machines. Two cones are employed with their tapering faces parallel. A shiftable transmitting wheel connects the two cones, transmitting the power from one cone to the other. The speed can be regulated by shifting the transmitting wheel along the surface of the driving cone away from or toward its apex.

Medical Apparatus.

RECEPTACLE FOR ETHYL CHLORID.—L. Schwartz, New York, N. Y. The invention relates to improvements in receptacles for ethyl chlorid and other fluids, such for example, as in devices for use by dentists or surgeons for producing local anesthesia. The receptacle is provided with an improved form of spray nozzle adapted to so tightly close the receptacle as to prevent the escape of the highly volatile fluid.

Railway Improvements.

CAR-SEAT.—L. Janson, Brooklyn, N. Y. The car seat is of that class in which two seats proper are mounted on a common support and connected by devices for causing them to turn in unison. The seats are held to turn on vertical axes, but are not allowed other movements. A latch is pivotally mounted on top of the base and is arranged to normally engage and hold the seats from turning.

COAL-CHUTE.—W. H. Simms, Grand Island, Neb. The coal-chute is designed to be used in connection with bottom-dump coal cars. The chutes are built in series along a high trestle work, so that the coal cars on the tracks along the top of the trestle may discharge their coal directly into an engine or car standing on tracks at the bottom of the chute on either side thereof.

Vehicles and Their Accessories.

BRAKE-BLOCK.—J. S. Odgers, Central City, Col. The invention is designed to furnish an improved brake-block for buggies, wagons and all wheeled vehicles which shall provide a stiff and rigid connection for the rub-iron to the operating bar that carries it, so that the brake-shoe will not become loose and tilt on its point of support, and yet provide a construction which will permit the position of the brake-shoe and rub-iron to be adjusted to the plane of the wheel, whose dish is sometimes changed in adjusting new tires to the wheel.

PEDAL-BALANCE. — F. H. Anderson, Walhalla, N. D. The object of this invention is to provide a suitable construction whereby to properly balance a pedal provided with a toe-clip so as to prevent its being turned by the weight of such clip.

REIN-HOLDER.—J. Granger, Springer, New Mexico. The rein-holder may be readily attached to a dashboard or other part of the vehicle, and the reins may be easily engaged and clamped thereby, especially when the harness trace is slack, so that the reins cannot be drawn out by a forward pull.

Miscellaneous Inventions.

DOUBLE IRONING-BOARD.—J. M. Gernert and J. F. Aten, Bellevue, Ohio. Two ironing boards are foldably connected with each other, which enables the use of either board. The boards are of different marginal forms, and one board becomes the base for the support of the other, which is being put in use.

NECKTIE-FASTENER.—A. N. Dow, Exeter, N. H. The device which is of simple construction is designed to effectually hold a tie or bow of any form and prevent it slipping upward at the front of the collar.

NECKBAND-SHAPER.—M. H. Ellenbogen and A. L. Levy, Paterson, N. J. The neckband-shaper is readily adjustable to different sized neckbands, and may be conveniently applied to the neckband to hold the same in proper position during the ironing of the shirt yoke to insure proper setting and uniformity in shape.

BELT-CLAMP FOR BUCKLES.—L. Sanders, Brooklyn, N. Y. The invention provides a clamp for a belt adapted to be used in connection with a buckle, and the device is so constructed that the ends of the belt may be readily and conveniently connected and the belt rendered larger or smaller to any extent within the limit of its adjustment.

BOOK-COVER.—F. C. G. Knibb, London, and Thomas R. Towler, Woodford, England. The improvement relates particularly to book covers of yielding material, such as are designed to be carried in the pocket. The invention provides means for rendering the cover stronger at the edges than are the usual covers.

TRIPOD.—W. K. Holmes, Brooklyn, N. Y. The tripod is constructed with telescopic leg sections, which are so arranged that when drawn out to their full extent they may be held in this lengthened position by simply turning the sections slightly in one direction.

KITE.—H. J. Trainor, Jersey City, N. J. The kite has certain peculiarly arranged whistles therein, and a telephonic receiving device connected therewith which is adapted to be held in the hand of the person flying the kite, the connection being such that the noise of the whistles will be communicated to the receiver.

VEIL-FASTENER. — W. Bernstein, New York, N. Y. The veil fastener is adapted for permanent use on a lady's hat, to allow of quickly and conveniently securing the veil in place. The fastener is rather inconspicuous and hence does not mar the appearance of the hat.

CALENDAR-BLOTTER.—S. M. Dewey, Rutherford, N. J. Mr. Dewey has provided a convenient blotter and a daily calendar in such a manner that a new blotting sheet or a new calendar can be readily inserted and securely held in position for convenient blotting of sheets and for displaying the day of the week, month, and year, together with suitable advertising matter.

BUILDING-BLOCK. — A. De Man, New York, N. Y. The building block is designed for use in fireproof flooring constructions, especially such as have I-beams for floor supports. The building block reaches from one floor-supporting beam to the next adjacent one, and is arranged to permit the convenient handling and placing of the blocks in position, one alongside the other, to form a sectional slab of great strength and durability, producing a flat ceiling and straight top surface.

STOP-MOTION FOR MECHANICAL TOYS.—A. D. Converse, Winchendon, Mass. The device provides an effective means whereby when the motor or mechanical toy is wound up it will not act upon the axle or wheel of the toy with which it is connected until the toy is brought in contact with the support upon which it is adapted to travel.

NECKTIE-FRAME.—A. Cole, Hood River, Oregon. The frame is made from one piece of spring wire, thus dispensing with a separate cardboard or metal piece, and the device is so constructed as to constitute an efficient form of support for the body or knot portion of the tie and provides means for attachment to a collar-button and any style of turndown collar.

CHURN-COVER.—T. H. B. Van Hoozer, Comanche, Texas. The churn-cover embodies a closed, dead air space above the body of the churn, a guide tube for the dasher rod, and a special construction at the outer edge of the base of the cover which provides a channel to fit upon the upper edge of the churn body.

SHOWCASE.—A. Reinle, Baltimore, Md. In this invention Mr. Reinle provides a novel form of resilient joint strip for application between the abutting plates of glass. The strip is so constructed that it will overlap both edges of the plate of glass, thus dispensing with the necessity and expense of grinding the edge of such plate.

SHOE-LACE FASTENER.—L. H. Hancock, Fargo, N. Dak. This device is adapted to securely hold and clamp the loose ends of a lacing or string to the upper part of a shoe, thus obviating the necessity and inconvenience of tying the strings.

GARMENT-STRETCHER.—H. A. Brown, Macon, Ga. By this invention Dr. Brown has produced a simple device which is light, so it can be easily carried in a valise and will occupy but little room therein and which can be used for creasing trousers whenever desired. This result is effected without the use of irons.

BURGLAR-ALARM.—W. H. Moody, Dallas, Texas. This economical, portable, cartridge-discharging burglar alarm is adapted for attachment to a window or a door, and is so constructed that it will be quick and positive in its action, and may be left indefinitely in firing position without detracting from its usefulness. A simple locking device is provided which may be set to hold the hammer cocked, permitting the device to be carried with comparative safey.

FLOOD-GATE. — H. B. Casperson, St. Marys, Ohio. This flood-gate belongs to the class wherein a horizontally-hung gate is associated with a fender that is arranged to face up-stream. In the present invention the gate and its fender are permitted to assume horizontal confined positions on the rising of the water, so as to float thereon when the flood is at its height. Means are provided for opposing the rising motion of the gate and the fender, which means is also free to be lifted thereby on an increase in the volume of the flood, thus minimizing all liability of injury to the parts.

Designs.

ORNAMENTAL FRAME FOR TEAPOTS OR SIMILAR ARTICLES.—E. Piepenbring, Washington, D. C. The design is in the nature of a silver or other metallic frame of ornamental character embracing the body of the vessel, and is jeweled and ornamented to represent holly sprays with the berries, and has a shield-like figure and edge ornamentations producing an extremely ornamental and attractive frame.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each Please state the name of the patentee, title of the invention, and date of this paper.

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Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 2795.—Parties to manufacture an improved handle for Mrs. Potts' sadirons.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

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Inquiry No. 2797.—For parties to make an endless combination belt of hair and rubber exposing immovable hair on the face and rubber on the inner side.

We design and build special and automatic machinery for all purposes. The Amstutz-Osborn Company, Cleveland, Ohio.

Inquiry No. 2798.—For dealers in corks coated with a rubber-like composition.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 2799.—For a knurling tool for making embossed paper of special pattern.

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

Inquiry No. 2800.—For parties engaged in ball-bearing and model work.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 2801.—For dealers in appliances for chemical work.

Ideas Developed.—Designing, draughting machine work for inventors and others. Charles E. Hadley, 564 Hudson Street, New York.

Inquiry No. 2802.—For makers of tin cans about 4 inches high and 1¾ inches in diameter, with enameled advertising thereon.

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Inquiry No. 2804.—For an apparatus for reproducing written reports in numbers.

Inquiry No. 2805.—For dealers in cigar-vending machines, selling them outright.

Inquiry No. 2806.—For dealers in blades for lawn mowers.

Inquiry No. 2807.—For manufacturers of roof tile machinery.

Inquiry No. 2808.—For galvanized wire hoops similar to those used on candy buckets.

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Inquiry No. 2810.—For spring motor ceiling fans.

Inquiry No. 2811.—For a light, portable distilling apparatus for use in deserts where water is strongly alkali.

Inquiry No. 2812.—For parties to make glass balls 2 inches in diameter, ground and polished and of different colors.

Inquiry No. 2813.—For manufacturers of portable houses.

Inquiry No. 2814.—For a large practical dish washer.

Inquiry No. 2815.—For carpet-cleaning apparatus or machinery,

Inquiry No. 2816.—For a floor mop that does not require wringing by the hands.

Inquiry No. 2817.—For an apparatus for placing in a vertical furnace so as to use oil as fuel.

Inquiry No. 2818.—For some economical fuel to be used instead of coal.

Inquiry No. 2819.—For dealers in rubber specialties.

Inquiry No. 2820.—For makers of double-action suction pumps.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

June 17, 1902,

AND EACH BEARING THAT DATE.

(See note at end of list about copies of these patents.

Air and hydrocarbon, apparatus for supplying, W. N. Best 702,529
Air brake testing apparatus, Saum & Mercatoris 702,679
Animal trap, Polk & Wood 702,676
Applicator and syringe, combined, L. J. Lohlein 702,570
Axle attachment, vehicle, J. W. Hafer 702,424
Badge medallion, J. E. Miller 702,737
Bag. See Water bag.
Bag holder, J. P. Adams 702,685
Balance or scale, automatic, E. G. Hedman 702,726
Baling press, F. M. Chappell 702,626
Ball pitcher, mechanical base, C. Edwards 702,415
Basket or bucket, folding, R. H. Hazen 702,650
Bearing, J. N. Everett 702,641
Bed, L. N. Bachand .....702,688 to 702,692
Bed and wardrobe, folding, C. J. Weiss 702,838
Bed bottom, P. B. Rooney 702,485
Bed, Davenport, L. N. Bachand 702,691
Bed pan, E. A. Stockdale 702,603
Beds, reclining chairs, etc., jointed frame for sofa, G. W. Britton 702,699
Bedstead, C. B. & F. White 702,839
Bedstead grate, A. Brecht 702,533
Beehive heater, electric, H. Vogeler 702,833
Bicycle, G. M. Lilburn 702,804
Bicycle construction, J. C. Pratt 702,743
Bicycle seat post clamp, J. H. Rast 702,589
Bicycle support, E. Moss 702,862
Bicycle wheel carrier, C. R. Smith 702,829
Blind fastening device, N. O. Bond 702,397
Block signal system, P. O. Keilholtz 702,656
Boat, C. Schaer 702,823
Boat, life, L. Brown 702,599
Boat, submarine, J. P. Holland 702,728, 702,729
Boiler, H. Bergfleth 702,694
Boiler or other furnace, steam, W. F. Wilmoth 702,756
Boiler setting, E. R. Eddins 702,414
Bolster, E. W. Palmquist 702,818
Bookbinder's press punch, P. A. Bowen 702,698
Book holder, E. S. Antisdale 702,761
Books, making, A. R. Dressel 702,413
Boot or shoe, F. W. Slater 702,600
Bottle capping machine, J. H. Fox 702,716
Bottle, non-refillable, F. J. Braconnier .. 702,532
Bottle, non-refillable, S. J. Daykin 702,709
Box fastener, J. H. S. Johnson 702,798
Brake mechanism, P. J. McCullough 702,812
Brake shoe, A. L. Streeter 702,890
Brick molds, safety appliance for sanding and feeding, H. Schoonmaker 702,824
Bronzing machine, G. Hare 702,551
Brush, J. F. Bowditch 702,530
Brushes, brooms, etc., apparatus for attaching or detaching handles of, J. Elstone 702,712
Bucket dumping device for steam shovels, Porter & Beaumont 702,473
Bulkhead door, W. W. Ife 702,651
Burial robe, H. K. Burket 702,773
Cake dropping apparatus, cup, W. J. Meikleham 702,576
Camera, photographic, C. F. J. Niss 702,464
Camera stand, J. H. Smith 702,749
Canceling machine, stamp, G. R. Sherwood 702,494
Cane conveyor, sugar, C. H. McNally 702,813
Car bolster, H. C. Buhoup 702,701
Car door, sliding, J. Player 702,742
Car fender, W. B. Rohmer 702,484
Car loader, box, D. A. Chappell 702,625
Car route indicator, M. O. Parenteau 702,819
Car side bearing, railway, C. H. Williams, Jr. 702,896
Car stock, J. F. Clark 702,631
Car wheel, M. P. Gerbing 702,644
Carbid cartridge, E. M. Rosenbluth 702,594
Carbon holder, S. B. Whinery 702,514
Carbonator, beverage, J. H. Fox 702,518
Carbureter, W. S. Deringer 702,637
Carbureter, explosive engine, J. W. Parkin 702,469
Cartridge clip, E. G. Parkhurst 702,882
Case. See Eyeglass case.
Cashier, mechanical, Dement & King 702,710
Casket handle attachment, H. Riegel 702,746
Centrifugal separator, P. L. Kimball 702,441
Centrifugal separator, I. V. Holmes 702,795
Chain, L. D. Howard 702,874
Chain protection, driving, E. Catchpool 702,775
Chain retaining and releasing means, J. J. Galway 702,549
Chair, H. W. Bolens 702,768
Chair attachment, rocking, D. F. Clifford .. 702,632
Chair spider, H. W. Bolens 702,769
Chimney cap, revolving, A. E. & F. J. Cook 702,779
Cigar lighter, W. F. Kessler 702,438
Cigar lighter, electric, W. F. Kessler 702,437
Clamp, J. Fellows 702,416
Clasp, C. A. Bryant 702,771
Clip, P. H. Yawman 702,523
Clock, electric program, J. O. Lyman 702,808
Clock movements for starting or stopping machinery, apparatus actuated by, J. S. Sunderland 702,682
Clock synchronizer, electric, C. F. Mears .. 702,666
Cloth cutter, S. Geczynski 702,788
Cloth, etc., device for unrolling, H. L. Rosenthal 702,822
Clothes pounder, S. B. Tadlock 702,506
Coal crusher, A. W. F. Steckel 702,889
Coal, etc., machine for washing, F. R. Wilson, Jr. 702,897
Cog wheel, F. Saxon 702,747
Collection form, A. F. Sanford 702,487
Colors, making mordant, Lange & Emilewicz 702,445
Composition of matter and preparation of same, W. Prampolini 702,678
Concrete mixing machine, C. Otis 702,881
Conveyer, J. H. Cook 702,408
Conveyer, A. J. Webster 702,894
Cooker and turner, cake, Arner & Goodwin 702,525
Cooking apparatus, steam, W. C. Salmon .. 702,597
Copper ores, apparatus for treating, R. Seeman 702,490
Corn husking machine, W. H. Gernand 702,720
Corn shocker, J. F. Steward 702,602
Corset steels, etc., socket for, N. F. T. Hunt 702,559
Cot and tent, combined folding, D. I. Kuhn 702,567
Cranberry assorting apparatus, A. E. Nightingale 702,583
Crate for poultry, folding, A. F. Dice 702,411
Curtain fixture, J. Burley 702,537
Curtain hanger, A. F. Goshorn 702,420
Curtain or shade fixture, F. E. Sircolomb. 702,827
Curtain pole, L. J. Graff 702,723
Curtain rod, M. P. Creahan 702,707
Dental appliance, H. E. Lindas 702,805
Dental bridgework, securing device for, W. E. Griswold 702,871
Dental fastening and bridgework, W. E. Griswold 702,857
Dental impression cup, W. E. Griswold 702,645
Dental tool, W. E. Griswold 702,646
Dilator, C. G. Gibson 702,789
Display tray, jewelry, J. P. Angell 702,853
Dock, land reclaiming, E. Chaquette 702,627
Dogging machine, steam, A. S. Hill 702,727
Door strike, E. Bommer 702,696
Draft rigging, combined friction and direct acting spring, J. J. Hennessey 702,426
Drawer support, F. O. Anderson 702,389
Dredge, clam, E. Chaquette 702,628, 702,629
Dredge, floating, E. Chaquette 702,705
Dress shield, J. F. Murphy 702,667
Dress supporter, R. F. Montgomery 702,456
Drill. See Rock drill.
Ear drum, artificial, U. Kleiner 702,800
Egg tray, W. Darling 702,780
Electric battery, P. Delafon 702,544
Electric conducting wire, H. & E. Hammesfahr 702,725
Electric generator, dynamo, B. G. Lamme. 702,658
Electric maximum demand indicator, A. Wright 702,846
Electric meter, maximum and minimum recording, A. Wright 702,849
Electric motor speed regulating means, B. G. Lamme 702,657
Electric synchronous apparatus, W. M. Miner .....702,452 to 702,454
Electric wires or cables, conduit for, R. W. Lyle 702,662, 702,663
Electrical machine collector ring, R. Siegfried 702,599
Electricity meter, A. Wright 702,844, 702,848
Electricity meter, direct or continuous current, A. Wright 702,845
Electricity meter of the electrolytic type, A. Wright 702,850
Electricity metering, A. Wright 702,847
Electrochemical generator, H. S. Amwake. 702,760
Electrodes, graphitizing, E. G. Acheson 702,758
Embalming and cooling board, Turney & O'Sullivan 702,511
Engine controlling mechanism, Dannenberg Morgan 702,410
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Envelop and advertising opener therefor, F. Theilengerdes 702,508
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Filter, oil, T. Neuray 702,814
Firearm, revolving, J. H. Wesson 702,607
Fire escape, Hendricks & Thompson 702,858
Fireman's mask, J. B. Reid 702,481
Fires in closed compartments, apparatus for extinguishing, H. B. Febiger 702,713
Fires in closed compartments, extinguishing, H. B. Febiger 702,714
Floor construction, W. H. Barrar 702,616
Floor jack, R. J. Weiland 702,837
Floor rubber, C. F. Lemcke 702,569
Fluid pressure coupling, W. H. Simmons .. 702,497
Fluid pressure engine, R. C. Sayer 702,488
Fluid pressure engine, A. C. Smith 702,601
Fluid pressure regulator, P. H. Hamilton .. 702, 82
Fly paper holder, Eaton & Norton 702,547
Fruit box, W. Clement 702,776
Fruit jar, H. B. Burns 702,702
Furnace, W. F. Wilmoth 702,755
Furniture coupling, Brunner & Root 702,623
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Garment supporter, H. N. Northrop 702,816
Gas burner, T. Holland 702,873
Gas burner, incandescent, C. W. Taylor .. 702,830
Gas generating and burning furnace, C. M. Gearing 702,418
Gas generator, acetylene, D. H. Treichler .. 702,604
Gas generator, acetylene, Buckley & Phinney 702,772
Gas producing apparatus, T. H. Muller ... 702,580
Gear, elliptic chain driving, W. F. Williams 702,841, 702,842
Gearing, differential, C. H. O. Hamann .. 702,793
Generator. See Electric generator.
Glass cutter, circular, D. B. Johnson 702,732
Glass glazing apparatus, Coleman & Runyon 702,633
Glass to molds, mechanism for feeding, T. Coleman, Jr. 702,634
Gold separator, C. W. Gardner 702,643
Golf practice apparatus, A. R. Smith 702,828
Grain drill furrow opener, disk, R. H. Schlachter 702,598
Grain spout, B. Kienholz 702,440
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Grinding machine, drill, C. Ridderhof 702,885
Grinding mill, ball, M. F. Abbe 702,757
Gun breech mechanism, L. N. D. Mixsell .. 702,455
Gun, water, C. H. Radcliffe 702,478
Hand guard and wrist supporter, G. L. Pierce 702,471
Harrow, W. Powers 702,475
Harvester, bean, J. H. Stanton 702,502
Hasp fastener, A. Voight 702,605
Hat brim trimmer, Griffeth & Morehouse .. 702,870
Hay on wagons, device for binding, J. H. Winterowd 702,520
Heating furnace, W. Gorman 702,722
Hinge, F. Dyer 702,640
Hinge, spring, W. A. Skinner 702,888
Hoe, E. C. Lewis 702,659
Hoisting apparatus brake, H. Votsch 702,834
Hoop nailing horse, lining, W. J. Ott 702,467
Horses' feet, anti-slipping pad for, T. F. Hayes 702,794
Hose adapted for couplings, etc., flexible, M. Montgomery 702,738
Hosiery with lacework stripes, manufacture of seamless, W. Wilson 702,843
Hub, vehicle, J. E. Foley 702,548
Hydraulic jack, W. K. Stansbury 702,501
Hydrocarbon burner, A. Mende 702,449
Hydrocarbon burner, retort, Duncan & Wafer 702,638
Hydrocarbon lighting system, F. A. & R. D. Cody 702,406
Hydrocarbon vapor burner, L. G. Heist ... 702,553
Hydrogen chlorid and sodium sulfate, making, T. Meyer 702,877
Ice making apparatus, automatic skimming regulator for, A. O. Frick 702,856
Illuminator, W. Harvey 702,649
Indigo, purifying raw, B. Homolka 702,730
Insulator and manufacturing same, F. M. Locke 702,661
Insulators, making, F. M. Locke 702,660
Internal combustion engine, J. F. Hobart. 702,430
Jar closure, F. E. Dopheide 702,412
Joist, bridging, C. ●. Nelson 702,462
Journal box, G. A. Woodman 702,899
Journal box lid, G. A. Woodman 702,900
Journal box lid, dust proof, G. A. Woodman 702,901
Ladder, step, Mau & Paesel 702,574
Lamp, carriage, E. M. Rosenbluth 702,595
Lamp circuit and cut out, electric arc, M. H. Baker 702,392
Lamp, inclosed arc, W. L. Cheney et al ... 702,405
Lamp reflector shade, electric arc, W. E. Goldsborough 702,791
Lawn sprinkler, H. H. Gray 702,792
Leather, stretching, J. Caldwell 702,867
Leather surface, finishing, C. H. Miller ... 702,450
Lens, etc., spring clamp for, E. L. Lembke 702,803
Letter box attachment, Tracy & Gould 702,510
Linotype machine, P. T. Dodge..702,781 to 702,783
Liquid fuel burner, J. W. Neumann 702,880
Loom finishing replenishing mechanism, G. F. Hutchins 702,876
Loom for weaving bordered fabrics, Cumnock & Warren 702,635
Loom shuttle, I. F. Peck 702,672
Loom shuttle, N. Caisse 702,703
Loom warp stop motion, H. J. Jarry 702,654
Looms, mechanical warp stop motion for, H. Wyman 702,609
Mail box, J. M. Reasoner 702,479
Malt kiln, T. Haynes, Jr. 702,552
Mangle, W. E. Andree 702,687
Massage machine, Pfanschmidt & Siefert .. 702,820
Match machines, power transmitting device for, T. W. Synnott 702,683
Measure, oil, G. E. Bernard 702,767
Mechanical movement, B. Ivor 702,652
Metal bending machine guide, C. Weber .. 702,836
Metal surfaces, producing designs or delineations on, Bartle & Hoen 702,693
Metals from ores, recovering, Neill & Burfeind 702,582
Meter. See Electric meter.
Mining machine truck, A. Palmros 702,817
Mirror, bicycle, P. A. Aurness 702,763
Molds, chaplet for supporting cores in, W. A. Bole 702,620
Mosaic blocks, die for cutting, W. A. Arnold 702,391
Motor, H. de Chardonnet 702,404
Motor generator, P. J. Collins 702,407
Motors, cooling attachment for internal combustion, F. Thourot 702,750
Mowing machine finger bar adjusting device, C. G. Hunter 702,433
Mowing machine gearing, W. A. Kirby .. 702,442
Multiple switch, H. H. Cutler 702,409
Music sheet perforating apparatus, H. M. Salyer 702,887
Musical instrument, automatic stringed, Wood & Stiles 702,898
Mustache guard, E. C. Gladwin 702,790
Nail clipper, right and left, H. Wilcox 702,516
Necktie fastener, I. S. Altman 702,610
Newspaper holder, J. Wilton 702,518
Nut and oil cap for wheels, combined axle A. C. Atkin 702,612
Nut cracking machine, A. Gerstmayr 702,721
Nut lock, C. W. Faist, Jr. 702,642
Nut lock, T. C. Bornman 702,770
Oil burner, W. R. Jeavons 702,560
Oil feeder, L. G. Nilson 702,815
Oil tank, J. J. Paquette 702,584
Opera chair, folding, A. R. Milner 702,451
Ore concentrator, Cohen & Gross 702,541
Ore elevator, H. A. Vezin 702,892
Ore pocket, Hoover & Mason 702,731
Oxygen generating retort, F. B. Felt 702,855
Package for fragile articles, H. C. Lord. 702,807
Packing, rod, T. W. Mitchell 702,578
Panel raiser, L. S. Depoe 702,711
Paper feed mechanism, Peters & Hungerford 702,673
Parer and cutter, G. Giovanna 702,419
Penholder, R. L. McNiece 702,739
Photographic film protecting strip, W. F. Maulick 702,575
Photographic plate for reproducing ink impressions, L. C. Henriot 702,554
Piers, etc., shifting device for, Baldwin & Sundh 702,393
Pile or nap fabrics, apparatus for producing, J. Eaton 702,854
Pillow sham holder, T. Bambauer 702,765
Pipe connection, G. F. Ryan 702,596
Pipes, etc., hanger for, A. B. Carll 702,704
Planter grain ejector, corn, A. J. Marshall 702,572
Planter marker, seed, N. E. Schoonover. 702,825
Planter, seed, E. L. Caraway 702,401
Playing ball, E. Kempshall 702,799
Pliers, I. A. Coon 702,542
Plow attachment, W. G. Ball 702,647
Plow attachment, combination, W. A. Jeffers 702,561
Pocket closure, J. H. Syme 702,505
Powder filling and folding machine, F. A. Robinson 702,591
Powder filling and wrapping machine, F. A. Robinson 702,482
Power for car axles, means for transmitting, E. H. Johnson 702,655
Printing and embossing press, plate, W. Fullard 702,787
Printing press, A. E. Dowell 702,546
Printing press driving means, S. G. Goss. 702,421
Projectile, A. W. Mattson 702,664
Pulp washing apparatus, A. Hinzke 702,556
Pulverizer, land, H. Howe 702,859
Pump, J. W. Reynolds 702,590
Pump and bailer, sand, W. E. Johnston .. 702,436
Pump and bailer, sand, F. W. Jackson 702,653
Pump, centrifugal, W. S. Sharpneck, reissue 12,001
Pump motor, P. S. Woods 702,521
Pumping apparatus, J. W. Simmons 702,496
Puzzle, G. F. Barden 702,615
Radiator, C. W. Rogers 702,483
Rail, compound truss, E. T. Morlan 702,579
Rail joint, W. A. Paine 702,468
Rail joint, C. D. Jones 702,562
Rails, bars, etc., mechanism for straightening, C. E. White 702,840
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Railway, electric, J. C. Henry 702,427
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Reclining chair, J. W. & E. A. Clark 702,540
Reel. See Tape reel.
Rein support, J. T. Smith 702,498
Retort rakes, making, G. M. Portman 702,821
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Rotary engine, C. A. & O. W. Hult 702,558
Rotary engine, W. L. Casaday 702,624
Rotary engine, P. Phillip 702,674
Rotary engine, E. F. Pickett 702,675
Rubber dam holder, E. N. Beall 702,394
Sad iron, H. Frabin 702,422
Safe, C. V. Peckham 702,883
Sanitary receptacle and cesspool, McFoy & Gilmore 702,811
Sash cord fastener, E. L. Blackman 702,395
Sash fastener, R. D. Logan 702,806
Sash fastener or holder, J. W. Cade 702,774
Sash locking mechanism, Brooks & Whittaker 702,700
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Sawing machine, gang edger, A. E. Roe. 702,592
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Seeding machine, J. H. Samuels 702,486
Sewed articles, seam for, C. McNeil 702,668
Sewing machine folding guide, C. L. Weatherwax 702,512
Sewing machine thread cutting mechanism, R. W. Thomson 702,832
Shade bracket, E. M. Winfrey 702,519
Shade holder, A. McKenzie 702,460
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Shoe protector, J. H. Price 702,476
Show case or show front, C. F. Kurz 702,444
Sign, J. B. Schmidt 702,863
Siphon filling machines, salts injector for, J. H. Fox 702,717
Slicing machine, C. R. Zorsch 702,852
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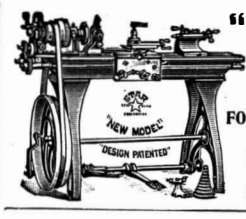
Stalk cutter, W. R. Welsh 702,513
Stamping machine, H. Watkins 702,753
Starch, manufacturing, J. Loiselet 702,571
Steam generator, J. L. Giroux 702,550
Stereotype plate and base, C. S. Partridge 702,470
Stitch indenting machine, A. Olson 702,465
Stone, apparatus for the manufacture of artificial, F. Marx 702,573

(Continued on page 456)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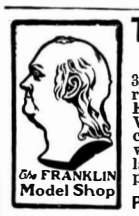
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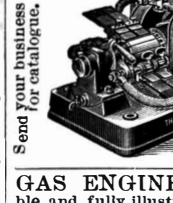
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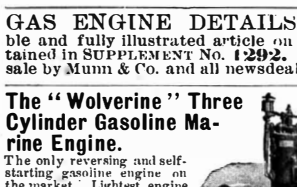
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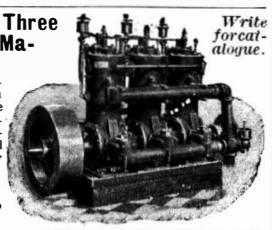
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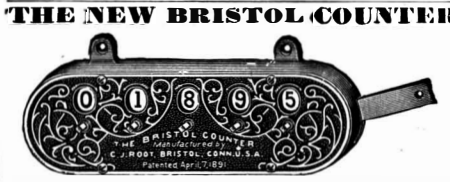
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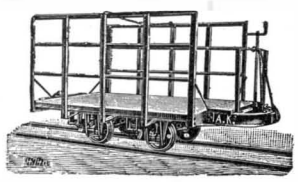

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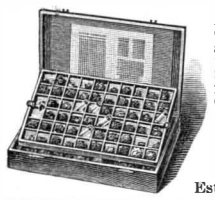

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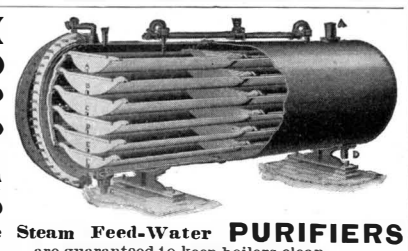

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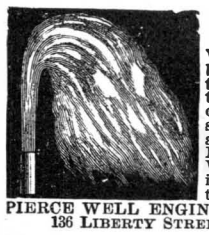

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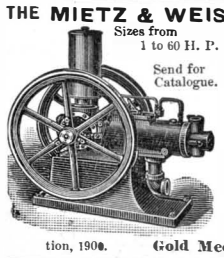

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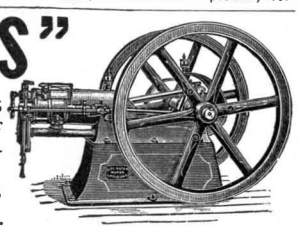

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Type setting machine key mechanism, F. McClintock	702,457
Type writer escapement mechanism, W. G. Babcock	702,613
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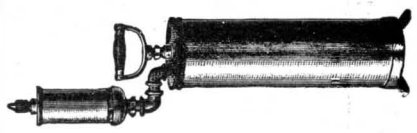

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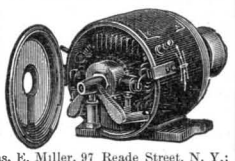

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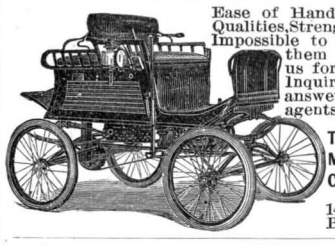

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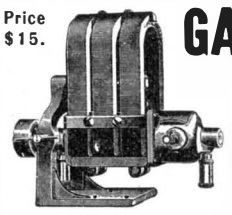

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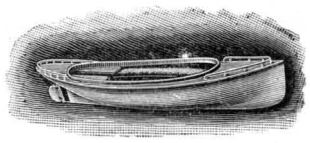

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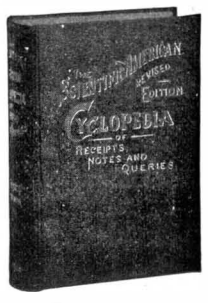

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INDEX.

ILLUSTRATIONS.

A

Accumulators, automobile .. 351
Acetylene gas explosions.... 203
Acid, carbonic, solid..... 303
Aeronautics, experiments in. 125
Aeroplane, British 308
Air currents, study of..... 75
Air pump, automatic..... 227
Airship, British 308
Airship "Pax" 362
Airship, Santos-Dumont No. 7 121
Airship, Severo 224
Airship, Severo, end of..... 395
Airship, Severo, wreck of.... 362
Alcohol automobile 37
Ambulance, electric 225
Analyzer, gas 93
Antenna, Guavani 169
Apiculture 416, 417
Armaturing machine 87
Ash sifter, dustless 328
"Asie," capsizing of..... 258
Aspen tunnel 86
Assay Office, New York.101, 188
Atbara bridge 184
Automobile, alcohol 37
Automobile cell, Gould..... 351
Automobile coupe 226
Automobile frame, flexible.. 225
Automobile mail van..... 104
Automobile, marine 143
Automobile, Mercedes 384
Automobile, modern, types.. 133
Automobile motor, oscillating 384
Automobile, Overman 139
Automobile race, Nice..... 384
Automobile, racing, Baker.. 419
Automobile seat, new..... 152
Automobile sled 145
Automobile, three-wheel 227
Automobile tires 150
Aviators 173
Axle bearing, automobile.... 152

B

Barges, tractor, canal..... 394
Basket machine 185
Bataclan, horse 191
Battery, international 351
Battery plates 351
Battleship "Gaulois" 378
Battleship "Mikasa" 326
Battleship "Missouri," launch 20
Bicycle attachments 420
Bicycle on runners..... 145
Bicycle, walking 369
Block, spring, new..... 208
Boiler, locomotive 251
Boiler, locomotive, Regan.... 243
Boat, fishing, motor..... 452
Boat on wheels, a..... 276
Boat, submarine, Armorl.... 40
Book typewriter 436
Bees, construction by..... 241
Bee culture 416, 417
Braiding mechine 87
Brake, Duryea 147
Breadmaking, mechanical .. 1
Bread machinery 379
Bridge, a three-arm..... 398
Bridge, Atbara 184
Bridge, East River, caisson. 375
Bridge, railway, moving a.. 412
Bridge, Redheugh 117
Bridge, trestle, Salt Lake... 256
Bridge tunnels, constructing. 72
Brush, hair, coin-in-slot..... 420
Bug trap, a..... 209
Bureau and trunk..... 436
Burglar alarm, automatic... 60
Burner, gasoline, Welsbach.. 52
Burner, hydrocarbon 208
Burner, hydrocarbon, lantern 332
Burner, Lane 138
Butter, formation of..... 349
Butterine, wrapping 450

C

Cables, submarine, mfr..... 83
Cabot tower 4
Caisson of East River Bridge 375
Canal boat, tractor..... 394
Canal, Erie, improvements... 290
Canal excavator for Java.... 294
Canal, Isthmian 33
Canal, Isthmian, work..... 67
Canal, Nivernais 394
Car, automotor 413
Car, mail, automobile..... 104
Car, motor 168
Car, polyphase 91
Car, repair 311
Car, "saddle" 6
Car, tipple 27
Car, touring, Packard..... 146
Car, touring, Peerless..... 142
Car, War, Simm's..... 350
Cars, jack to lift..... 70
Cars, self-dumping 399
Carbureter, alcohol 37
Carbureter, Packard 146
Card puncher, Hollerith..... 269
Carriage, Duryea 147
Carriage, ether-motor 9
Carriage, steam 136
Carriage, steam, Lane..... 138
Carriage, the Knox..... 140
Castings, Messine 21
Catamaran, cycle driven..... 145
Catamarin, Fiji 443
Cathedral, ruined 433
Cave-in at Park Avenue, 221, 237
Census taking, mechanical... 269
Chicago clearing yard..... 70
Clamp, carpenters' 242
Clamp, lantern-slide 174
Claw bar, adjustable..... 315
Club, Indian, illuminated.... 369
Clutch, Phillips' 291
Coal loading machine..... 105
Collision, rear-end 453
Columns of Hall of Records. 395
Comet, Brook's, 1902..... 414
Computing triangle 202
Conveyor, ore, progressive... 378
Cop, V-wound, a..... 220
Copper refining, electrolytic. 181
Coral strand, Fiji..... 443
Cottonfield, Georgia 236
Coupling, shaft, Davis..... 279
Cow milker, new..... 315
Crab, the largest..... 353
Cranberry industry, the..... 206
Crane, derrick, locomotive... 367
Crane, traveling, for guns... 277
Crane, traveling, electric.... 435
Crusher, ore 453
Curie experiment 328
Cycle whirl 144
Cynips polycera 382

D

Daguerreotypes 262
"Decatur," launch of..... 254
Dinosaur, Jurassic, geat.... 5
Dock, Howard's 345
Dock, dry, Algiers..... 169
Dock, dry, Bermuda..... 237
Doppersburg station 53
Dough divider 379
Drills, centering, tool for... 242
Drive-gate, auto..... 315
Drydock, Algiers 169
Dune grass for sand drifts. 127
Dust collector 22
Dustpan and sprinkler..... 60
Dynamite explosion, New York 90
Dynamo, ignition 202

E

Earthquake recorders 400
Electrometer, Lippmann's .. 400
Emery wheel, portable..... 331
Engine, Duryea 147
Engine, rotary, new..... 27
Engine, steam, Lane..... 138
Engine, steam, oscillating.. 384
Engine, steam, White..... 136
Engines of Edison power sta. 199
Engines, hoisting 412
Erie Canal improvements.... 290
Etchograph, the 121
Ether motors 9
Excavator, canal, for Java.. 294

F

Falls, Shawenegan, power plant 41, 42
Farm card, census..... 275
Feedbag, new 420
Fire alarm, automatic 60
Fire alarm whistle 70
Fire escape, pneumatic..... 168
Flour mixer 379
Fluids, motion of, study.... 75
Fly, feeding, on honey dew 241
Flying machine, Villard..... 173
Forum, Roman, discoveries.. 297
Fossil bones, preparing..... 5
Fountain of Juturna..... 297
Freight, handling, New York 418
Friction clutch, Phillips'.... 291
Friction clutch pulley..... 385
Furnace, blast, modern..165, 172

G

Gages, tide 259
Garments, Siberian 368
Gas, acetylene, explosions... 203
Gas analyzer 93
Gate, drive, new..... 315
Gas whistle, fire alarm..... 70
Gasoline burner, Welsbach.. 52
Gasoline motor, novel..... 291
Gasoline touring car..... 146
"Gaulois," battleship 378
Gear, speed changing..... 243
Gear, sped, for pumps..... 120
Generator, ether-vapor 9
Generator, White 136
Glass, engraving 273
Glassware, manufact. process 323
Gnats and midgets in winter 295
Grader, road 24
Grape basket machine..... 185
Grass, pampas 400
Grid, the Madden..... 352
Gulls, tame 333
Gun shops at Essen..... 296
Gun-sight, telescopic 209
Guns, cast iron, breaking... 295
Gutta percha press..... 87

H

Hall of Records, new..... 395
Hammer, steam, Krupp..... 277
Hardware locomotive 20
Harrow, Schaffer 37
Heater, a new..... 347
Heater, water, electric..... 174
Hill climbing contest..... 384
Hogs, cutting up..... 450
Honey, wild, gathering..... 417
Horn growth, curious..... 105
Horse, Bataclan 191
Hose, metallic 398
Houseboat, Lorillard 149
Houseboat "Rancocas" 148
Hub, steel, massive..... 21
Hut, Fiji 443
Hydrometer, home-made 106

I

Ice box, folding 397
Ignition dynamo 202
"Indiana," launch of..... 254
Indicator, horse power..... 60
Indicators, tide 259
Indicators, railway station.. 243
Insect, geometrician, an.... 278
Insects in winter..... 295
Iroquois rite, ancient..... 401

J

Jack, lifting, for cars..... 10

K

Kava, drinking, Fiji..... 448
Kelvin, Lord 307
Keyboard, typewriter 453
King, Clarence 19
Kite, great Marconi..... 4
Kneading machine 379

L

Lard pails, filling..... 450
Lamp, electric, Armorl..... 40
Lamp, flash, new..... 93
Lamp hanger, new..... 385
Lamp, Nernst 25
Lamp, night, simple..... 105
Langen suspended railway, 49, 53, 54
Lantern, dark 315
Lantern slide clamp..... 174
Lathe attachment 369
Launching, broadside 254
Lawn sprinkler 242
Levuka, Fiji Islands..... 443
Level and plumb..... 174
Lever device, Smyth's..... 38
Light, search, in photography 184
Light, stereopticon, new.... 332
Lighting above and under water 239
Lions, sea, tame..... 333
Lobster, a monster..... 353
Lock, nut, new..... 59
Locks, canal, at Cohoes..... 290
Locomotive boiler 251
Locomotive boiler, Regan.... 243
Locomotive, electric 42, 413
Locomotive, hardware 20
Locomotive, oil-burning 220
Locomotive, powerful 308
Locomotive, wrecked 35
Locomotives, American .391, 396
Loop, N. Y. Central..... 58
Lord Kelvin 307

M

Mail van, automobile..... 104
Marconi, experiments of..... 4
Martinique, disaster in..... 365
Match box, bicycle..... 420
Measuring vessel 209
Modeling in sand..... 76
Monitor, "Scorpion" 416
Motor, Balzer 140
Motor car 168
Motor, Duryea 147
Motor, gasoline, novel..... 291
Motor, Knox 140
Motor, rotary, new..... 27
Motor starter, Crest..... 152
Motor, steam, Lane..... 138
Motor, steam, oscillating.... 384
Motor, steam, White..... 136
Motor, wave and tide..... 385
Motor, wave, Santa Cruz... 8
Motors, ether 9
"Mikasa," battleship 326
Missions, old Spanish..... 56
"Missouri," launching of.... 20

N

Nail puller, Salo..... 6
Nefs, a collection of..... 127
Nut lock, new..... 59

O

Oak, creeping, a..... 74
Oil can and pump..... 93
Oil fields, submarine..... 36
Oil wells, submarine..... 36
Omnibus, gasoline 142
Orange peeler 209
Ordnance, heavy 258
Ore conveyor, progressive... 378
Ore hauling 172
Oven, bread, new..... 379
Oven shelf, automatic..... 174
Ozone for sterilizing water. 452

P

Paddle wheel, Horton..... 71
Palace, glass, Drury Lane Theater 233
Pampas grass 400
Passengers, unloading 6
"Pax," airship 362
Pelicans 261
Penstocks, large 41
Phonograph recorder 93
Photography of fluids..... 75
Photography by trains..... 272
Photography, headlight 120
Photorama, the..... 344
Pigeon loft, a..... 111
Pile driver, electric..... 331
Pistol, sword..... 242
Plants, reflex action..... 431
Planter, a handy..... 420
Plow, hilling up..... 208
Plow, snow..... 124
Plug, sparking, Wydt's..... 37
Pompeii 382
Power house, Belgo-Canadian 41
Power station, elevated railway .....
Press, hydraulic, 5,000 ton.. 277
Press, printing, electric.... 409
Printing, electricity in..... 409
Projector, photographic..... 184
Pulley, friction clutch..... 385
Pump, air, automatic..... 227
Pump, bicycle..... 420
Pump, mixing 432
Pump valve..... 397
Pumps, speed gear for..... 120
Punch, population card..... 269
Python, feeding a..... 57

R

Race, Nice-Turbie..... 384
Racer, steam, Serpollet's.... 350
Radium rays, experiment.... 328
Rafflein Arnoldi..... 241
Rail joint, improved..... 122
Railroad, Union Pacific..... 240
Railroads in Cuba..... 383
Railroading, winter, Alaska. 124
Rails, steel, manufacture, 287, 341
Railway bridge, moving a.. 412
Railway, elevated, power station 17
Railway, Grosslichterfelde... 207
Railway, high speed, German 91
Railway station indicator.. 243
Railway, suspended, Langen, 49, 53, 54
Railways, underground..... 305
Ramblersville 345
Redheugh bridge..... 117
Reflector, two-foot, a..... 109
Revolver and dark lantern.. 315
Rice threshing in Texas.... 236
Road making, mechanical.... 24
Road scraper..... 24
Rock pillar at Acoma..... 349
"Rollo," launch..... 143
Runabout, Ajax..... 148
Runabout, gasoline..... 142

S

Sampson, Admiral..... 343
Sand drifting, Cape Cod.... 127
Sand, modeling in..... 76
Sausage-drying room..... 451
"Scorpion," monitor 416
Screen, expansible 60
Searchlight, electric 272
Shale, column of..... 349
Shawenegan Falls power plant 41, 42
Shell practice, city armory, 217, 222
Shipyard material, handling 366, 367
Shovel, muck..... 86
Shower bath apparatus..... 174
Silk, reeling 430
Silworkworm culture.....430, 431
Signal, night, trolley line.. 255
Sisal plantation 312
Skate, ice, spring..... 209
Sled, automobile..... 145
Sled motor..... 227
Smoke deposits..... 330
Snow plow..... 124
Soldering iron, new..... 420
Sparking dynamo..... 202
Sparking plug, Wydt's..... 37
Spectrum of water vapor... 239
Speed changing gear..... 243
Speed gear for pumps..... 120
Speed transmission, variable 273
Sprinkler, lawn..... 242
Stanhope Gramobile 142
Stanhope, Grout 139
Station indicator..... 243
Stations of Langen railway. 53
Steam carriage, White..... 136
Steam chest, locomotive..... 396
Steam racer, Serpollet's.... 350
Steamships, Atlantic, growth of 309
Steel plate exhauster..... 243
Stereopticon light, new..... 332
Street cleaner, sanitary.... 327
Street gas analyzer..... 93
St. Pierre, ruins of.....427, 433
Sundew, the 431
Switch, automatic..... 202
Switch, plug..... 227
Sword pistol..... 242

T

Tabulating machine..... 269
Target, electric 446
Telegraphy, wireless, apparat. 10
Telegraphy, wireless, Armorl 40
Telegraph, wireless, Marconi 4, 74, 169
Telephone, wireless, apparat. 296, 363
Telescope, new, Oxford..... 189
Tellurian, Craddock 8
Thill coupling, new..... 93
Tiberius, bronze head of.... 401
Tide gages 259
Tide predicting machine..... 312
Tipple, mine-car 27
Tire-repairing tool 59
Tires, automobile 150
Tonneau, electric 225
Tonneau, gasoline 142
Tool grinder, new 362
Tool receptacle, bicycle..... 420
Tractor barges, canal..... 394
Tractor in lumbering..... 447
Trades of old Spanish missions 56
Train photography 272
Tramway, bridge, electric... 172
Transformer, continuous-alternating current 452
Transmission, speed 273
Triangle, computing 202
Triceratops, model of..... 43
Trench diggers 434, 435
Tree growth, curious 368
Tree stand 315
Trees, California 74
Trees, moving, method 71
Trunk, new form of..... 436
Tunnel, Aspen 86
Tunnels, bridges, constructing 72
Turbine and dynamo, steam 52
Turbine, Rateau 348, 349
Turbines, 8,000 horse power. 41
Typewriter book 436
Typewriter, Hanson-Lee 279
Typewriter, Simplex 255

V

Valve for pumps..... 397
Vegetable cutter, new..... 59
Venice of Long Island..... 345
Venus' flytrap 431
"Vixen," yacht 143
Voltmeter, Eldredge 227

W

Wagon, steam, Stearns..... 137
War car, Simms..... 350
Warrior, Fiji 443
Washington, improvement of 108
Water level regulator..... 227
Wave motor, Santa Cruz.... 8
"Wave" Meke-Meke 443
Wave and tide motor..... 385
Welding machine 330
Wells, oil, submarine 36
West Indies, disaster in.... 359
Whirl, cycle 144
Whistle, fire alarm 70
Wool, pulling 450

Y

Yacht "Vixen" 143
Yachting in a desert..... 276
Yard, clearing, Chicago..... 70

Z

Zuni, ancient city of..... 313

MISCELLANY.

Figures preceded by a star (*) refer to illustrated articles.

A

Abydos, operations at..... 85
Accumulators, automobile ..*351
Acetylene, black 315
Acid, carbonic, solid.....*203
Acetylene, carbureted *368
Acetylene, experiments with 123
Acetylene, explosiveness of.. 257
Acetylene gas explosions....*203
Acetylene gas, increasing use of 106
Acetylene lighthouse 26
Acid, salicylic, in strawberries 154
"Adder," submarine boat... 380
Aeronautics, experiments in.*125
Aeronautics in 1901..... 2
Aeroplane and airship..... 306
Aeroplane, British, new.....*308
Aeroplane, the 270
Aerostatics, motors in..... 200
Africa, commercial prospects 410
Agriculture in the South...*236
Agriculture, secretary, report 23
Air, compressed, in glass mfr. *329
Air currents, study of.....*75
Air in tube railings..... 76
Air, permeability of..... 328
Air, vitiated, purifying..... 280
Airship and aeroplane..... 306
Airship, English, new.....*308
Airship, new, Santos-Dumont 103
Airship races, St. Louis.... 329
Airship, Severo *224
Airship, Severo, end of.....*395
Airship, Severo, trials of... 346
Airship, Severo, wreck of..*362
Airship, the 270
Airships, prizes for 69
Alcohol as motive power.... 55
Alcohol automobiles *37
Alcohol Exposition, new.123, *225
Alcohol industry in Germany 381
Alcohol motor, improvement.. 191
Alcohol motor, the..... 18
Alcohol motors in Germany.. 364
Alcohol motors, tests of..... 23
Alcohol motors, use of..... 89
Alloy, nickel steel..... 311
Alloys for brass and bronze.. 125
Anchor chains, 50-ton..... 429
Aluminium bronze, tests of.. 253
Aluminium saw handles..... 279
Amalgam on copper plates... 380
Ambulance, automobile 274
Ambulance, electric *225
Americanists, Congress of... 170
Ammunition, cost at Manila. 288
Animals, wild, tameness....*333
Aniline patent sustained.... 280
Ant gardens of Brazil..... 271
Anthracite in China..... 353
"Argonant," the, in court... 94
Armature winding, feat in.. 155
Armor plate for Russia..... 218
Armor plate tests..... 330
Arrow, an Esquimau..... 54
Artillery launches 274
Assay office, New York, *107, *188
Ash sifter, new.....*328
"Asie," capsizing of.....*258
Aspen tunnel *86
Asphalt case, the..... 210
Atbara River Bridge.....*184
Automobile accumulators ...*351
Automobile ambulance 274
Automobile clubs, English... 274
Automobile coupe *226
Automobile department *225
Automobile endurance test, 234, 325, 385
Automobile endurance test... 428
Automobile frame, flexible...*225
Automobile fuel storage..... 187
Automobile house, portable.. 145
Automobile in Porto Rico... 293
Automobile industry, 1901... 2
Automobile launch *143
Automobile mail van.....*104
Automobile, marine 143
Automobile news..6, 54, 89, 107, 123, 135, 187, 257, 274, 293, 332, 352, 381
Automobile novelties ..*152, *227
Automobile on the stage.... 134
Automobile passenger service 137
Automobile principle, applic. 135
Automobile race, Nice..350, *384
Automobile racing 260
Automobile, racing, Baker..*419
Automobile, rise and growth. 134
Automobile seat, reversible.*152
Automobile show, Chicago... 134
Automobile shows, Amer.... 271
Automobile sled *145
Automobile speed bill, Cocks 257
Automobile speed measurer.. 187
Automobile, stables 149
Automobile, steam, Overman *139
Automobile storage 226
Automobile tire, new....135, 187
Automobile tires *150
Automobile, three-wheel *226
Automobile touring outfit.... 134
Automobile, world touring .. 381
Automobiles, alcohol *37
Automobiles for fire use..... 89
Automobiles, gasoline *140
Automobiles in the army.... 6
Automobiles, military test of 139
Automobiles, oil fuel for.... 332
Automobiles, wear of roads by 137
Aviators *173
Axle bearing, automobile...*152

B

Babylon, ancient 333
Babylon, discovery in..... 350
Bacilli of upper atmosphere. 223
Baggage handling, Paris..... 205
Baldwin relief party..... 433
Baldwin, searching for..... 332
Balloon, dirigible, new..... 167
Balloon outfit, Sultan's..... 86
Balloon "Pax," end of..... 395
Balloon projects for the Sahara 256
Balloon, Santos-Dumont 88
Balloon, Zeppelin's, end of.. 19
Banks of New York city.... 414
Barges, tractor *394
Barium, preparation 76
"Barry," launching of..... 297
Basket machinery *185
Bataclan, horse *191
Bath, photo., new..... 20
Battery, the storage..... 148
Batteries, storage, charging.*202
Battleship "Gaulois" *378
Battleship "Mikasa" *326
Battleship "Missouri," launch *20
Bee culture *416
Bell, submerged, signaling by 94
"Belleisle," defence ship... 190
Belt mounters, competition... 432
Bergama, archaeolog. finds at 223
Berthoud-Thoune railway ...*413
Bicycle, a snow.....*145
Bicycle attachments *420
Bicycle, novel *369
Bicycle novelties 332
Bicycle whirl *144
Bicycles, gear changes for..*243
Bicycling problem 364
Bird mummies at Lyons..... 111
Bird tragedy, a..... 171
Birds, native, protection of.. 119
Black, acetylene 315
Bleaching, new method..... 27
Block, spring, new.....*208
Blood, circulation of the.... 22
Boat, fishing, motor..... 452
Boat on wheels.....*276
Boat, submarine, "Adder"... 380
Boat, submarine, Goubet's... 435
Boat, submarine, new...*40, 410
Boat, submarine, pleasure.... 369
Boat, 2,000-year old..... 223
Boats, motor, exhibition of. 278
Body, chemical value of..... 256
Boiler, explosions in England 171
Boiler, locomotive *243
Boiler, locomo., oil-burning..*220
Boiler, locomo., water tube, *256, 376
Boiler, steam, inspection..... 119
Boiler, water-tube, German.. 106
Boiler, water tube, on locomotives 242
Boilers, water tube, comparison 252
Bologna, leaning tower of... 412
Book typewriter *436
Books, text, Amer., abroad.. 201
Bore, tidal, picture of a..... 103
Bottle, journey of a..... 361
Brake, air, Westinghouse.... 421
Brake, Duryea *147
Brake trials, important..... 107
Braking tests, comparative.. 352
Brass, alloys for..... 125
Bread making, mechanical, *7, *379
Bridge at Zanesville.....*398
Bridge, Atbara River.....*184
Bridge, Brooklyn, decking the 102
Bridge, Brooklyn, relief for. 200
Bridge, East River, aesthetics of 84
Bridge, East River, caissons of *381
Bridge, East River No. 3... 234
Bridge erection, novel method 252
Bridge, Firth, painting the.. 76
Bridge over the Tyne..... 394
Bridge, railway, moving a..*412
Bridge, Redheugh, new..... 122
Bridge, stone, Petrasse River 52
Bridge tunnel, Penn. R. R. .*72
Bridge, Wheatstone, novel use 191
Briquettes of garbage..... 257
Bronze, alloys for..... 125
Bronze, aluminium, tests.... 253
Bronze, tensile strength..... 254
Bug trap *209
Bulkheads, watertight 18
Bull fight with motor car.... 89
Bureau and trunk.....*436
Burglar alarm, new..... *60
Burner, the Lane.....*138
Burner, gasoline, Welsbach.. *52
Burner, hydrocarbon *208
Butter industry of Australia. 167
Butter preservation 239
Buttes, formation of.....*349

C

Canal, Erie, improvements..*290
Cables, submarine, mfr..... *87
Cable, submarine, new..... 155
Cable, Transpacific 126
Caissons of East River bridge *381
Canal boat, tractor.....*394
Canal, Darien, route..... 118
Canal engineers, Isthmian, work 473
Canal, excavator for Java...*294
Canal, Isthmian 34
Canal, Isthmian and disturbances 392, 397
Canal, Isthmian, report...34, 68
Canal, Nivernais, barges....*394
Canal, Panama, treaty..... 306
Canal problem, the..... 88
Canal routes, comparison.... *39
Canal, Sault Ste. Marie..... 429
Canal scheme, Austria's..... 295
Canals, German 223
Cane sugar, test for..... 201
Cape Cod, the sands of.....*127
Car, freight and oil..... 421
Car, motor, new.....*168
Car, New Haven, wrecked... 50
Car shortage, our..... 110
Car, tipple, mine railway... *27
Car, touring, gasoline.....*146
Car, touring "Peerless".....*142
Carbureter, alcohol *37
Carbureter, Packard *146
Cars, electric, jack for..... *70
Cars, freight, large order for 76
Cars, mail, automobile.....*104
Cars, mail, fireproof..... 376
Cars, metal, boom in..... 123
Cars, "saddle" *6
Cars, self-dumping *399
Cars, street, sanitary condit. 306
Carriage, gasoline, Duryea..*147
Carriage, gasoline, Knox....*140
Carriage, Stanley, in court.. 244
Carriage, steam *136
Carriage, steam, Lane.....*138
Carriage, steam, White.....*136
Cartridge contrivance, new.. 123
Cascaret case, the..... 61
Casting, Goldschmidt method 27
Catamaran, cycle-driven *145
Cats, accidents caused by... 106
Cave-in, Park Avenue.*221, *237
Celluloid phonograph records. 191
Cement, Portland, domestic. 122
Census machine *275
Central Park, maintenance, cost 398
Chains, anchor, 50-ton..... 429
Chair, oak, old, discovery.... 310
Chamonix electric line..... 204
Charleston Exposition 54
Chemistry school of Berlin.. 261
Chicago clearing yard..... *70
Claims, construing 61
Clamp, carpenters' *242
Claw-bar, adjustable *315
Clinker, furnace, utilizing... 292
Club, Indian, illuminated...*369
Clutch, friction, Phillips....*291
Coal, American, in Germany. 257
Coal, anthracite, first use... 244
Coal, centennial of 72
Coal cutting machine, new.. 223
Coal or oil, early suggestion 449
Columns of Hall of Records.*395
Comet, Brooks', of 1902..... 414
Coal-loading machine *105
Coalfield, new, Asia..... 328
Coal, soft, at Asch..... 292
Coal, spontaneous combustion 72
Coaling warships under way. 292
Coast lands, reclaiming..... 102
Coin detector, electric..... 239
Coin, gold, for bullion..... 364
Coils, retardation, Pupin.... 364
Collision, rear-end *453
Collisions at sea, apparatus. 369
Comet, a new..... 296
Commerce, U. S., expansion. 376
Computing triangle *202
Confectionery, chemistry of.. 330
Consumption hospital, glass. 119
Conveyor, ore, progressive...*378
Cooling machine, new..... 435
Cop, V-wound, primitive....*220
Copper, electrolytic refining.*187
Copper, extraction, Hoepfner proc 332
Copper ore, treatment of.... 421
Copper removed from mercury 171
Copyright infringement 210
Cordite, explosive qualities.. 257
Cork stopper, passing of..... 174
Coupe, automobile *226

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Coupling, shaft, Davis.....*279
Cow milker *315
Crafts in Spanish missions.. *56
Cranberry industry *206
Crane, traveling, electric....*435
Crematory for light refuse... 328
Cruiser "Spartiate" 186
Crusher, ore *453
Custaceans, monster 353
Cunard liners, new..... 182
Curie, experiments of.....*328
Current transformer, simple. 209
Currents, alternating, frequency 208
Currents, high voltage..... 347
Currency, peculiar 296
Cyanide patents, New Zealand 61
Cycle trade, employes..... 19
Cycle whirl, the.....*144
Cynips polycera *382

D

Daguerreotype, the *262
Damages, personal injury.... 104
Darien tunnel canal route... 118
"Decatur," launch of.....*254
Detonator, dynamite 55
Diet, electric 59
Dinosaur, Jurassic, great.... *5
Divers, apparatus for..... 191
Dock at Avonmouth..... 415
Dock, dry, new, Algiers.....*169
Dock, floating, Bermuda.....*337
Drills, centering, tool for...*242
Drive gate, automatic.....*315
Drydock, large 185
Drydock, new, Algiers.....*169
Dune grass for sand drifts..*127
Dust collector, a..... *22
Dustfall in Europe, 1901..... 271
Dustpan and sprinkler..... *60
Dynamite explosion, New York 84, *90
Dynamo, ignition *202

E

Earthquake at Shemakha.... 272
Earthquake recorders *400
East River bridge No. 3.... 234
Education, scientific, Wurtemberg 19
Education, scientific, Ger.... 428
Eggs, preserving 27
Egypt, archaeology of..... 289
Electrical notes..55, 89, 106, 123, 155, 171, 205, 223, 239, 274, 296, 332, 347, 364
Electricity on trains, dangers of 274
Electricity direct from heat. 219
Electricity in printing..... 415
Electricity, progress, 1901... 3
Electricity, use on railways. 89
Electricity, uses, novel..... 92
Electrocuting a snake..... 204
Electrolysis case, Dayton.... 352
Electrometer, Lippmann *400
Electro-optical phenomena... 35
Engine, gasoline, advantages 144
Engine, marine, units..... 18
Engine, rotary, new..... *27
Engine, steam, Lane.....*138
Engine, steam, new era..... 200
Engine, steam, oscillating...*384
Engines, Edison power sta..*205
Engines, heavy, money savers 446
Engines, high speed, testing.*327
Engines, kerosene, market for 257
Engineering, civil, 1901..... 2
Engineering, mechanical, 1901 3
Engineering notes..26, 55, 89, 106, 123, 154, 171, 205, 223, 242, 257, 292, 311, 328, 347, 364, 380
Engraving glass with sand..*270
Etching, simple method of..*121
Etchograph, the *120
Ether generator *9
Ether-vapor generator *9
Erie Canal improvements...*290
Excavator for Java, an.....*294
Expedition, Jesup, return of. 109
Expedition, polar, a new.... 103
Exhibition, Glasgow 19
Exploration, Antarctic 170
Explosives, safe 234
Exposition, alcohol, new.... 123
Exposition, Charleston 54
Exposition, Pan-American embar 85
Expositions of 1901..... 2
Extensometer, new 222

F

Falls, Shawenegan, power... *42
Fan, electric, winter use.... 294
Farming, winter, expansion of 253
Fauna, cave, Malayan..... 271
Feedbag, new *420
Fenders, street car..... 94
Fever, malarial, new source. 271
Fiji and Fijians.....*448
Films, electro deposited..... 397
Fire alarm, thermostatic.... *60
Fire alarm whistle..... *70
Fire escape, pneumatic.....*168
Fire inspection for hotels... 218
Fire losses in America..... 234
Fire on shipboard..... 70
Fire, Park Ave. Hotel..... 182
Fishes, house cleaning for... 331
Flame, sensitive, experiment 345
Flames, musical 257
Fleet, British, reorganization 153
Fleets of the world..... 288
Floating dock, Bermuda.....*237
Flour, milk 59, 121
Fluid, motions of..... *75
Fluorine, utilization of..... 346
Flywheels, power lost in.... 353
Flying machine, Villart.....*173
Fog lights in London..... 434
Fog signaling 205
Food experiments in children 223
Forestry in the Philippines... 126
Forum, Roman, excavations.*297
Fossil monster, mounting.... *43
Frame, automob., flexible....*225
Freight handling, New York*418
Friction clutch, Phillips.....*291
Friction clutch pulley.....*385
Fuel, liquid for steamships. 360
Fuel, liquid, long voyage with 257
Fuel, oil, foreign use of..... 326
Fuel, storage of..... 149
"Fulton," trip on the..... 433
Furnaces, iron, electrical.... 106

G

Gages, tide *259
Garbage consuming plant.... 124
Garbage, incineration of.... 328
Garments, Siberian *368
Gas, acetylene, explosions ..*203
Gas, acetylene, increasing use 106
Gas analyzing apparatus.... *93
Gas, changing use of..... 110
Gas, coal mine, for Paris.... 107
Gas meters, inspection of.... 377
Gas pipes, freezing of..... 388
Gas, street, history of..... 250
Gas whistle, fire alarm..... *70
Gasmobile, Stanhope *141
Gasoline automobiles *140
Gasoline burner, Welsbach... *52
Gasoline carriage, Duryea...*147
Gasoline motor, advantages.. 144
Gasoline motor, novel.....*291
Gasoline motor, perfecting... 35
Gasoline touring car.....*146
Gasoline vehicles, starting... 135
Gate, drive, automatic.....*315
"Gaulois," battleship *378
Gear changer, bicycle.....*243
Gear, speed, for pumps.....*120
Geological Society of Amer.. 51
Generator, ether vapor..... *9
Generator, pyromagnetic 219
Generator, steam, White....*136
Genoa electric incline..... 326
Germany, export trade of.... 102
Glass decoration, simple method *273
Glass, malleable 365
Glass pavements in Paris.... 106
Glass, soluble 60
Glassware, manufacture of..*329
Glucinium, new salt of..... 103
Goggles, automobile 332
Gold-bearing quartz 347
Gold, device for saving..... 174
Gold, loss in tailing..... 328
Gold product of Rhodesia.... 89
Gramophone, home-made 204
Granite as an insulator..... 190
Grape-nut trade mark..... 61
Grass, Pampas, uses of..... 400
Gun, electro-magnetic, new. 223
Gun sight, telescopic.....*209
Gun, the Gathmann..... 324
Gun trade, Birmingham..... 89
Guns, breaking up of.....*295
Guns, rapid-fire, heavy..... 222
Guncotton, inexplosive 271
Gutta percha substitute..... 59

H

Hair brush, coin-in-clot.....*420
Hall of Records, new.....*395
Hardware, locomotive 20
Harrow tooth, novel..... *37
Harvard College, gift to..... 258
Havana transformed 360
Haze, autumn, cause of..... 201
Healthy decadence 234
Heater, a new.....*347
Heating cars, odd method.. 449
Heating, novel method..... 328
Heating system, hot water..*174
Heavens in February..... 73
Heavens in March..... 167
Heavens in April..... 219
Heavens in May..... 307
Heavens in June..... 377
Heavens in July..... 445
Holy shroud, researches on.. 367
Horn growth, curious.....*105
Horse, jumping, Bataclan...*191
Horse power indicator..... *69
Horses, American, export... 451
Hose, a metallic.....*398
Hospital, glass, consumption 119
Houseboat, Lorillard *149
Houseboat "Rancocas" *148
Hudson River tunnel, revival 118
Hydrant output, measuring.. 94
Hydraulic plant at Vizzola.. 262
Hydrocarbon burner, new...*332
Hydrogen app., electrolytic. 107
Hydrogen, influ. upon iron.. 43
Hydrometer, cheap *106
Hyena-dog, the 224

I

Ice cream, peddled, dangers. 376
Ice box, folding.....*397
Ignition dynamo *202
Image, photo., imperf. defin. 376
Improvements, Marconi's ... 451
Indexing, chemical 411
India, letter from..... 257
"Indiana," launch of.....*254
Indicator, horse power..... *60
Indicator, station *243
Infringement, damages for... 175
Insects in winter.....*293
Insect geometrician, an.....*278
Instinct, where it fails.....*241
Insulator, electric 175
Insulator, granite as..... 190
Inventors, wealthy 270
Inventorship, evidence as to. 94
Invention, change by assignee 244
Inventions, curious 27
Inventions, interesting *209
Inventions, new *93
Inventions, new, need of.... 208
Inventions, oddities in.....*315
Inventions, profit in..... 92
Inventions, profit in..... 92
Inventions, possible 279
Inventions, interesting *60
Inventions, recently patented, 11, 28, 45, 62, 77, 95, 112, 128, 176, 192, 210, 228, 245, 263, 281, 298, 316, 334, 354, 370, 386, 402, 422, 437
Inventions, romantic side.... 369
Inventions, simple *174
Inventions, some simple.....*242
Inventor, qualities of..... 242
Inventors, incomes of..... 201
Inventors, Institute of..... 242
Iron and steel, German..... 380
Iron, influence of hydrogen.. 43
Iron, large shipment of..... 106
Iron, manufact., Stassano.... 331
Iron mines, Michipicoten.... 22
Iron ore in Porto Rico..... 381
Iron ships, compos. for, needed 106
Iroquois rite, ancient.....*401
Irrigation, government 444
Island, phosphate, new..... 325

J

Jack for electric cars..... *70
Jerome Park Reservoir..... 68
Journalism, yellow, sci. and. 203
Jugs, how made..... 331

K

Kelvin, Lord *307
Kelvin, Lord, greeting to.... 310
Kelvin, Lord, Honors for.... 347
Keyboard, typewriter *453
King, Clarence *19
King Edward as automobilist 147
Klondike, year 1901 in..... 38
"Kroonland," launch of..... 171
Krupp works at Essen.....*276

L

Laboratory, physical, national 394
Lace machine, new..... 280
Lake, new, Switzerland..... 398
Lamp, flash *93
Lamp hanger, new.....*385
Lamp, incandescent, temp., *25, 27
Lamp, Nernst 171
Lamp, night, electric, simple*105
Lamps, Nernst, pract. value. 85
Langen suspended railway... *53
Language, universal...7, 22, 72
Lantern, dark and revolver..*315
Lantern slide clamp.....*174
Lathe attachment *369
Launch, automobile *143
Launches, gasoline, artillery. 274
Launching, broadside *254
Lawn sprinkler *242
Lead mining, Wisconsin..... 201
Leather as a filter..... 201
Lead, removed from mercury 171
Legal notes.....61, 94, 175, 190, 210, 244, 280, 352, 420
Letter, garbled, used to deceive 94
Letters mailed, number English 289
Level and plumb.....*174
Lever device for oil rods.... *38
Library, Bodleian 398
Light, search, in photog.....*184
Light, stereopticon, new.....*332
Light, Welsbach, discovery of 93
Lighthouse, acteylene 26
Lighthouse, new, Dungeness. 89
Lightning, ball, at sea..... 36
Lightning conductors 239
Lightning above and under water *239
Lightning effects 414
Lignite, note on..... 328
Lime, how to slake..... 27
Linen, to soften..... 27
Liner, Atlantic, value of.... 364
Loop, underground, Central.. *58
Locomotive boiler *243
Locomotive boiler, water tube 376
Locomotive, American, the..*396
Locomotive, British, largest. 252
Locomotive, collapse of a.... 57
Locomotive, electric *413
Locomotive, hardware *20
Locomotive industry, Austria 380
Locomotive, oil-burning *220
Locomotive, powerful *308
Locomotives, Amer. in India 89
Locomotives, electric, in towing 55
Locomotives in Egypt..... 325
Lord Kelvin *307
Lord Kelvin, greeting to.... 310
Lord Kelvin, honors for..... 347
Lunch, hot, to pupils..... 103

M

Maddox, Richard L..... 429
Madonna of San Antonio, the 127
Magnet, var. at the Manacles 103
Mail car, automobile.....*104
Mail cars, fireproof..... 376
Mail collection recorder..... 155
Mail transportation in cities.*104
Mail van, automobile.....*104
Malaria, prevention of..... 38
Mammoth, discovery of a.... 253
Mammoth, the frozen..... 329
Man trap, ingenious..... *60
Manacles, new buoy at..... 435
Maple, bird's eye..... 415
Marconi, criticisms of..... 270
Marconi, experiments of..... *4
Marconi, latest feat of..... 186
Marine, mercantile, subsidized 166
Martinique, disaster in..346,*365
Masonry, St. Paul's Cath., exam 346
Match-box, handle bar..... 420
Match, lucifer, inventor..... 209
McClellan, Oscar, death of.. 432
Measuring vessel *209
Merchant marine in 1901.... 2
Merchant marine subsidies... 204
Mersey tunnel, traction in... 332
Metals, influ. of high temp.. 325
"Meteor III.," yacht.....*141
Meteorology, popular invasion 272
Meter, telephone 60
Meters, gas, inspection of... 377
Metric system, Kelvin on.... 314
Metric system in U. S..... 343
"Mikasa," battleship *326
Milk flour 59
Milk flour in Sweden..... 121
Minerals, valuable 393
Mines, iron, Michipicoten.... *22
"Missouri," launch of the... *20
Monitors, British, early.....*416
Monolith at Stonehenge..... 85
Monster, fossil, constructing *43
Mont Pelee, eruption of..... 392
Mont Pelee, investigation.... 410
Monument to Bazalgette..... 171
Mortality in United States.. 88
Morton, Henry, death of.... 347
Mosquitoes, extermination .. 293
Moth, knife of the..... 262
Motor, alcohol, improvement 191
Motor, alcohol, the..... 18
Motor car, new.....*168
Motor, electric and petrol... 332
Motor, fan cooled, Knox....*140
Motor, gasoline, advantages. 144
Motor, gasoline, Balzer.....*140
Motor, gasoline, novel.....*291
Motor, gasoline, perfecting.. 35
Motor, gasoline, starting.... 135
Motor, petrol, for boats..... 347
Motor, pyro-magnetic..... 219
Motor, rotary, new..... *27
Motor sled *227
Motor starter, Crest.....*152
Motor, steam, Lane.....*138
Motor, steam, White.....*136
Motor vehicle, new 332
Motor, wave and tide.....*385
Motor, wave, Santa Cruz.... *8
Motors, alcohol, Germany.... 364
Motors, alcohol, tests of.... 23
Motors, alcohol, use of..... 89
Motors, explosion, register for 123
Motors in aerostatics..... 200
Mount Etna railroad..... 365
Mountains and hail..... 451
Mummies, bird, at Lyons.... 111
Mushrooms, food value of.. 278
Music, influ. on animals..... 256
Mutoscope in the court..... 210

N

Nail puller, mechanical..... *6
Names, scientific, combining 244
Nature, study of..... 394
Navigation Congress 432
Navigation, submarine 324
Navy, appropriation bill.... 324
Navy bill, House..... 392
Navy, development, future.. 118
Navy program, British..... 183
Nicaragua Canal 34
Nice-Turbie race.....*384
Nickel-steel alloy 311
Nile reservoir, notes on..... 432
Nivernais Canal *394
Nome, visitors to..... 19
Nomenclature, scientific 235
Novelties, patented, recent..*420
Nefs, a collection of.....*126
Nelumbo, structure of..... 277
Newspaper title copyright... 190
Nut lock, improved..... *59
Nyassaland, indust. colony.. 205

O

Obituary, newspaper 58
Observatory, Yerkes, reflector *109
Ocean record, new..... 436
Officers, Amer. for Amer. ships 293
Officers, wants of, merch. marine 51
Orange peeler *209
Ordnance, heavy, object lesson *258
Ore conveyor, progressive...*378
Ore handling *172
Ore, iron, for concrete blocks 242
Ore separators, new..... 93
Osmosis, pressure in..... 221
Oven shelf, automatic.....*174
Oxford, Amer. scholarships.. 270
Oxygen apparat., electrolytic 107
Okapi, protection of the..... 86
Omnibus, gasoline-electric...*141
Omnibus service, motor, new 293
Oil can, pump..... *93
Oil drilling in California.... 123
Oil fuel, foreign use of..... 326
Oil wells, drilling *36
Oil wells, Texas, subsidence. 363
Ozone for sterilizing water. 452

P

Packing industry, Chicago..*450
Paddle wheel, Horton..... *71
Paint, machinery, heat-detect 279
Palace, glass, Drury Lane...*238
Pampas grass, uses of.....*400
Panama Canal 34
Panama Canal bill, Senate.. 444
Panama Canal treaty..... 306
Panama route, the..... 68
Park Ave. Hotel fire..... 182
Park Ave. tunnel, the..... 182
Park, Central, maintenance.. 398
Passengers, unloading from trains *6
Patent department..*26, *59, *92, *174, *208, *242, *279, *314, *369, *420
Patent law, Australian 209
Patent law, Japanese..... 92
Patent law, revised..... 361
Patent laws, British..... 314
Patent regulations, French.. 210
Patents, brief notes on..... 421
Patents, brief notes on, 94, 175, 280
Patents, construction of..... 280
Patents, notes on..26, 60, 191, 244
Paterson, flood at..... 190
Pavements, glass, in Paris. 106
"Pax," balloon, end of..... 395
Periodicals at Brit. Museum. 255
Pelee, eruption, witness of.. 392
Pelicans, notes on.....*261
Pension roll, the 418
Persia, trade route to, new. 50
Petrol, explosion of..... 89
Petroleum Institute, London. 55
Petroleum substitute, new... 364
Pets as pests..... 296
Pharmacists, liability of.... 210
Philippines, gov. contract in. 411
Phonograph, Edison, new.... *93
Phonograph, improvements in 93
Phonograph records, celluloid 191
Phonograph records, copyright 175
Photographing by a headlight*120
Photography, future of.....*262
Photographs, prizes for..... 449
Photographs, the first..... 42
Photographs taken by train.*272
Photorama, the *344
Picture projection, electric... 421
Pigeon ranch, a..... 111
Pipe threads, faulty..... 218
Pipes, gas, freezing of..... 398
Pistol, sword *242
Plant, 70,000 h. p..... 166
Paint, sale of in 1901..... 433
Plants for Botanical Garden. 223
Plants, odoriferous 271
Plants, reflex action.....*431
Planter, improved *420
Plow, antiquity of the..... 119
Plow, hilling up.....*208
Plow, snow, new..... 421
Plow, snow, rotary.....*124
Plow, power, Gatling..... 244
Plug, sparking, Wydt's..... *37
Plug switch, new.....*227
Pole, north, expedition to.... 103
Pompeii *382
Potassium hydride, experi... 124
Postage stamps, danger from 223
Portland cement, domestic... 122
Potential discharger patent.. 421
Power from rivers..... 171
Power direct from heat..... 219
Power plants, large, firing... 258
Power station, elevated railway *21
Printing, electricity in..... 415
Projection in photography...*184
Pulley, friction clutch.....*385
Pump, air, automatic.....*227
Pump, bicycle *420
Pump for automobiles..... 205
Pump troubles, automobile.. 107
Pump, mixing *432
Pump oil can..... *93
Pump valve, new.....*397
Pumps, speed gear for.....*120
Pyramids, electric light in... 239
Python, feeding a..... *56

Q

Quads, motor, Cape Colony.. 55
Quartz fibers with elec. arc. 222
Quartz, fusion of..... 360

R

Race, automobile, Paris-Vienna 257
Race, Nice-Abazzia 352
Race, Nice-Turbie.....*384
Races, automobile, Nice.....*350
Racing records, automobile.. 260
Radio-conductor, Branly 296
Radium rays, experiments on*328
Rail, joint, improved.....*122
Rail truck, new..... 280
Rail, railway, new..... 292
Rails, steel, manufacture, *292, *346
Railroad bridge, Tyne..... 394
Railroad, Brooklyn, congestion 106
Railroad charter, first..... 380
Railroad curves, speed on.... 218
Railroad, Mt. Etna..... 365
Railroad run, fastest..... 324
Railroad run, longest..... 433
Railroad, Southern Pacific...*256
Railroad speed device..... 88
Railroad, Trans-Siberian, notes 364
Railroad, Union Pacific.....*240
Railroads, Amer., report upon 288
Railroads, electric, Sweden.. 120
Railroads in Cuba.....*383
Railroads of 1901..... 3
Railroads, Spain 364
Railroads, tubular 392
Railroading, winter, Alaska.*124
Railway accidents, prevention 155
Railway, Bagdad 5
Railway bridge, moving a...*412
Railway, electric, Chamonix. 204
Railway, electric, Italy..... 22
Railway, electric, Milan.... 127
Railway, electric, Switzer...*413
Railway, elevated, pass. station *21
Railway employes, accidents to 242
Railway employes, hours work 19
Railway, Grosslichterfelde ..*207
Railway, high-speed, German *91
Railway, Manchurian 42
Railway, monorail, Scotch.. 223
Railway run, fast, New York-Chicago 444
Railway station indicator...*243
Railway, suspended, Langen *53
Railway, underground, Paris, 89, 205
Railway workmen, wages... 84
Railway, underground, ventilation 256
Rain, artificial production... 106
Railways, electr. or steam for 342
Railways, French, Abyssinia 252
Railways, tube, air in..... 76
Railways, underground, elec.*311
Rangefinder, new 280
Rays, Roentgen, burn..... 342
Rays, X, substitute for..... 368
Redheugh Bridge, new.....*122
Reflector, Yerkes Observatory*109
Regulator, water-level *227
Re-invention, case of.....*220
Reservoir, Jerome Park..... 68
Retrospect of 1901..... 2
Revolver and dark lantern..*315
Rivers, power from..... 54
Road making by machinery. *24
Rochambeau statue *378
"Rollo," launch *143
Roman remains, discovery... 436
Runabout, a light..... 187
Runabout, Ajax *148
Runabout, Haynes-Apperson.*141
Rubber boots for dogs..... 119
Rubber scrap, recovery of... 59
Rubber substitute 59
Rudder actuating by electric. 55

S

Safes, new designs in..... 421
Sahara, crossing by balloon. 329
Sampson, Admiral *343
Sand, modeling in..... *76
Sands of Cape Cod.....*127
Santos Dumont and Edison. 296
Santos Dumont in America. 274
Sap, acid reaction of..... 235
Sappho, new poems by..... 260
Sault Ste. Marie Canal..... 429
Screen, expansible..... *60
School, apparat., patent..... 421
Scholarships, Amer. Oxford. 270
Science, National Academy.. 289
Science notes....19, 85, 103, 119, 154, 167, 201, 223, 235, 253, 271, 289, 325, 346, 361
Scientific American award.. 363
Screws, twin, steering..... 306
"Scorpion," monitor *416
Sea of Azoff, shallowness of. 364
Searchlight, electric.....*272
Seismographs in America....*400
Sensation machine..... 208
Serpents, venomous, bites of. 412
Severn bore, picture of..... 103
Sewing machines, Brit. tariff 55
Shaft coupling, Davis.....*279
Shaft sinking by freezing.... 411
Shawenegan Falls, power.... *41
Shell practice in city armories *222
Shield, safety, for markers.. 393
Shipbuilding in England.... 205
Ship, defense, "Belleisle"... 190
Ship subsidy bill..... 68
Shipwreck prevention..... 59
Shipyards, handling material.*366
Shower bath apparatus.....*174
Sidewalk, moving, Brooklyn Bridge 218
Signal, night, for trolley lines *255
Silkworm culture in America.*430
Sisal industry, the.....*312
Skate, ice *209
Sled, automobile.....*145
Sled, motor, a.....*227
Smoke, consumer, novel..... 42
Smoke deposits, London....*330
Snake, electrocuting a..... 204
Snake-bite mortality 412
Snow melted by steam..... 186
Snow plow, rotary.....*124
Soldering iron, new.....*420
Soldiers, burial..... 104
South, agriculture in.....*236
Southern Pacific, new line.*253
Spark, electric, in water.... 223
Sparking dynamos.....*202
Sparking plug, ingenious.... 381
Sparking plug, Wydt's..... *37
"Spartiate," cruiser..... 186
Spectrum of water vapor..*239
Speed device, railroad..... *88
Speed gear for pumps.....*120
Speed transmission, variable.*273
Sprinklers, street 420
Spur, history of the..... 86
Squirrels and telephone cables 347
Stages, electric, New York.. 187
Stamp-canceling machines... 94
Stanhope, steam, Grout....*139
Starch, composition of..... 325
Statue, Rochambeau..... 378
Statuettes, Assyrian, metal of 294
Steamship, British, centenary 295
Steamship combination, great 306
Steamship combination 392
Steamship refrigerator..... 292
Steamships, transatlantic, growth *309
Steel and iron, German.... 380
Steel articles, hardening.... 27
Steel, Giebeler..... 208
Steel industry, vast..... 342
Steel panic, possibilities of.. 102
Steel plate exhauster.....*243
Steel rails, manufacture....*346
Steering with twin screws.. 306
Stereopticon light, new.....*332
Strawberries, the acid of.... 154
Street accidents in fogs..... 434
Street car fenders..... 94
Street cleaner, sanitary....*326
Street gas analyzer..... *93
Street signs, New York..... 104
Stones, precious 393
Storage battery suit..... 210
St. Pierre, ruins of.....*433
Submarine boat "Adder"... 380
Submarine boat, the..... 410
Submarine, Goubet's 435
Submarines, British..... 361
Submarines, guarding against 342
Subway, cave-in on.....*237
Subway, rapid transit..... 342
Suez Canal, sailing vessels.. 218
Sugar, cane, test for..... 201
Sun, temperature of the.... 253
Survey, Lane.....*138
Sven Hedin return from Thibet 204
Switch, crossover, electric.. 296
Switch, plug, new.....*227

T

Tagalog dictionary, a..... 235
Tantalum, preparation of... 236
Target, electric, Chevallier.*446
Target practice in navy.... 50
Teak timber industry..... 8
Telescope, Oxford, new.....*189
Telegraph, wireless, Guarini.*169
Telegraphy, wireless, and promoter 288
Telegraphy, wireless, Armorl system *40
Telegraphy, wireless, at sea. 51
Telegraphy, wireless, attuned 324
Telegraphy, wireless, Brown. 329
Telegraphy, wireless, cost of 166
Telegraphy, wireless, criticism 347
Telegraphy, wireless, in warfare 182
Telegraphy, inventions in.... 26
Telegraphy, wireless, Marconi *4, 74, 274
Telegraphy, wireless, new appliances 123
Telegraphy, wireless, new system *10
Telegraphy, wireless, suit... 352
Telegraphy, wireless, weather Bureau 314
Telegraph, printing, Murray. 76
Telegraphy, wireless, at sea. 186
Telegraphy, wireless, rivalry 274
Telegraphy, wireless, work in 170
Telegraphy, wireless, Zugspitz 89
Telephone, appar., new..... 364
Telephone appar., wireless..*296
Telephone, earth, experiments 167
Telephone, first invention... 208
Telephone, London and Brussels 296
Telephone meter 60
Telephone relay problem.... 205
Telephone system, military.. 4
Telephone wire net, Paris. 220
Telephones on trains.....60, 272
Telephones, restaurant..... 280
Tellurian, Craddock..... *8
Telephony, wireless, advance in *363
Temperature, subterranean.. 84
Temperature, low, producing 105
Terminal problem, N. Y. Central *58
Test paper, new..... 154
Theater, science in.....*238
Thunderstorm indicator..... 223
Thill coupling, new..... *93
Tiberius, bronze head of....*401
Tides, predicting the.....*312
Tides, indicating the.....*259
Timber, insect-proof..... 204
Time-signals, electric 414
Tipple, car, mine railway... *27
Tire, automobile..... 187
Tire-repairing tool *59
Tire, automobile, new..... 293
Tire, solid, decision..... 190
Tire, pneumatic, new..... 135
Tire, the pneumo-cushion... 135
Tires, automobile *150
Tonneau, electric *225
Tool-grinding attachment ...*362
Torpedo boat destroyer...84, 204
Torpedo boat fiasco, the.... 102
Torpedo suit, Whitehead.... 94
Torpedo steering, Armorl system 40
Torpedoes, controlling..... 60
Traction, electric, danger.. 69
Traction, electric, England. 296
Traction system, novel..... 6
Traction, three-phase, American 444
Tractor barges *394
Tractor in lumbering operations *447
Tool receptacle, cycle.....*420
Tower, leaning, of Bologna.. 412
Trade, British, revival of... 377
Trade dispute arbitration.... 205
Trade in the Congo..... 297
Trade libels, English..... 61
Trade mark infringement.94, 210
Trade mark registry..... 190
Trade mark, transferability. 280
Trade route to Persia, new.. 50
Trades in Spanish missions.. *56
Train signaling, automatic.. 10
Train, the fastest..... 166
Trains, elevated, electric... 50
Transformer, continuous-alternating current *452
Transit, rapid, London..... 171
Transmission, long distance. 68
Transmission, speed, variable*273
Transpacific cable..... 126
Tree stand *315
Trees and forests of California *74
Trees, Chinese, curious.....*368
Trees, moving, method of... *71
Trees, stunted, Japanese.... 235
Trench digging, extraord....*434
Triangle, computing *202
Tripoli, desert, exploration.. 154
Trolley, current, novel use..*330
Truck, rail, new..... 280
Trunk, new form of.....*436
Tube, electric, London..... 123
Tube railways, air in..... 76
Tube, the London..... 171
Tubes vs. shallow tunnels... 392
Tugboats, electric..... 274
Tunnel bill, Pennsylvania... 218
Tunnel, rapid transit, accident *221
Tunnel accident, New York. 50
Tunnel, Aspen..... *86
Tunnel, Hudson River, old.. 118
Tunnel, Park Avenue..... 182
Tunnel railway, Mersey, electric 55
Tunnel, Simplon, great..... 106
Tunnel tragedy, a..... *34
Tunnel wreck, Central yard. 69
Tunnels, bridge, constructing *72
Turbine destroyer, novel..... 218
Turbine, marine..... 68
Turbine plant, steam..... 252
Turbine, steam, introduction*348
Turbine, steam, novel..... *52
Turbine vessel, a new..... 106
Turbine yacht, Barber's..... 222
Turf for heating..... 332
Turin, archeolog., finds at.. 271
Typesetting, Chinese..... 203
Typewriter, book *436
Typewriter, Hanson-Lee *279
Typewriter, simplex.....*255

U

Units, marine engine..... 18

V

Valve for pumps.....*397
Vegetable cutter, new..... *59
Vehicles, electric.....*148
Vehicles, electric, London... 55
Vehicles, electric, novel.....*225
Vehicles, motor, prizes for.. 274
Vehicles, motor, trials of.. 6
"Velox," turbine destroyer. 218
Venice of Long Island.....*345
Ventilation 167
Vessels, Cunard, new..... 182
Vessel, iron, British, first.. 18
Vessels, sailing, Suez Canal. 218
Vermin on fowl, to destroy. 368
Victoria Nyanza, survey of. 253
Village, buried, California.. 346
Violet, a new species of.... 325
"Vixen," yacht.....*143
Volcano, Pelee, eruption of.. 392
Volcanoes and Isthmian Canal 360
Volcanoes, active and extinct 393
Volcanoes and Isth. canal, 392, 397
Volcanoes, eruptions of..... 414
Volcanoes, sun and moon.... 433
Voltmeters, Eldridge.....*227
"Vulcan," the..... 18

W

Wagon, steam, the Stearns..*137
Wages, effect of machines on 311
Wall paper, impermeable..... 27
War car, Simms.....*350
Warship, English, new..... 171
Warships, new, armament... 88
Washington, improvement of*108
Water, artesian, Australia.. 43
Water-level regulator.....*227
Water purifying installations 257
Water, viscosity of..... 154
Wave and tide motor.....*385
Wave detector, Fessenden... 324
Wave motor, Santa Cruz.... *8
Waves, electric, propagation 364
Wealthy, the, as inventors.. 270
Weather Bureau, work of. 234
Welding, electric *360
Welding, Goldschmidt, method 27
Well, artesian, of Grenelle.. 72
Wells, oil, drilling..... *36
West Indies, disaster in....*365
West Point Academy, reconstruction 288
Whistle, fire alarm..... *70
Whale skeleton, Yuma..... 361
Window glass, blowing..... 175
Wood preservation, electric.. 191
Workmen, English, American, method 252
Writing, the oldest piece of. 235

Y

Yacht "Meteor III."..... *141
Yacht, turbine, steam..... 222
Yacht "Vixen"..... *143
Yachting in Great Desert...*276
Yard, clearing, Chicago..... *70
Year 1901, the, retrospect of 2

Z

Zeppelin, ruin of..... 329
Zuni *313

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"Tropical Cigar," for cigars, Schmidt & Co.	9,241

PRINTS.

"Men's Apparel," for men's apparel, W. C. Both	524
"1902—Fall & Winter—1903," for clothing, Crouse & Brandegee	519
"Potted Ham and Tongue, Deviled Ham and Tongue," for potted and deviled ham and tongue, Armour Packing Co.	518
"See That Flare," for women's underwear, H. M. Love	520 to 523

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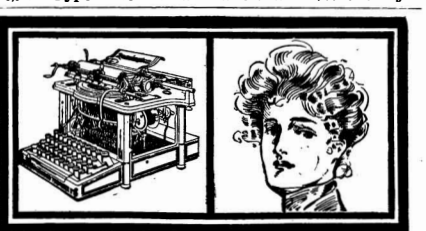

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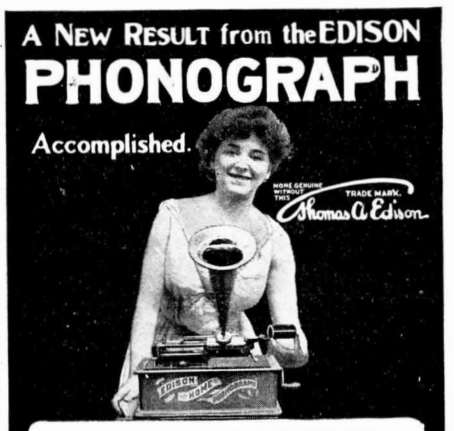

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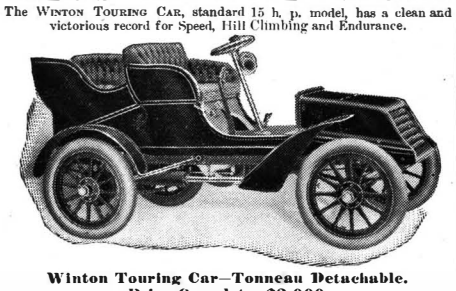

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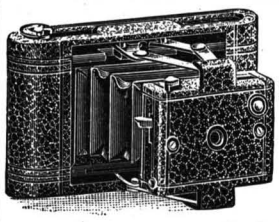

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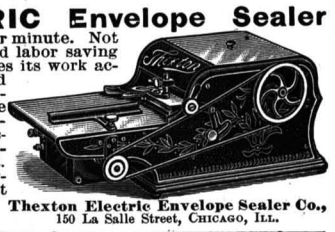

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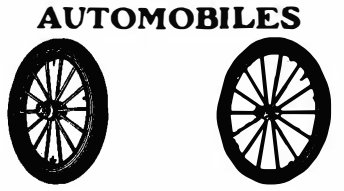

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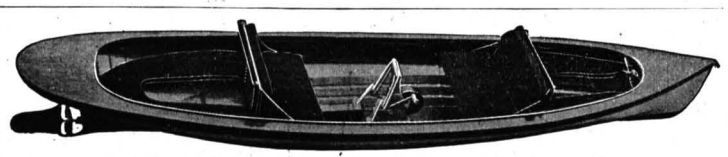

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